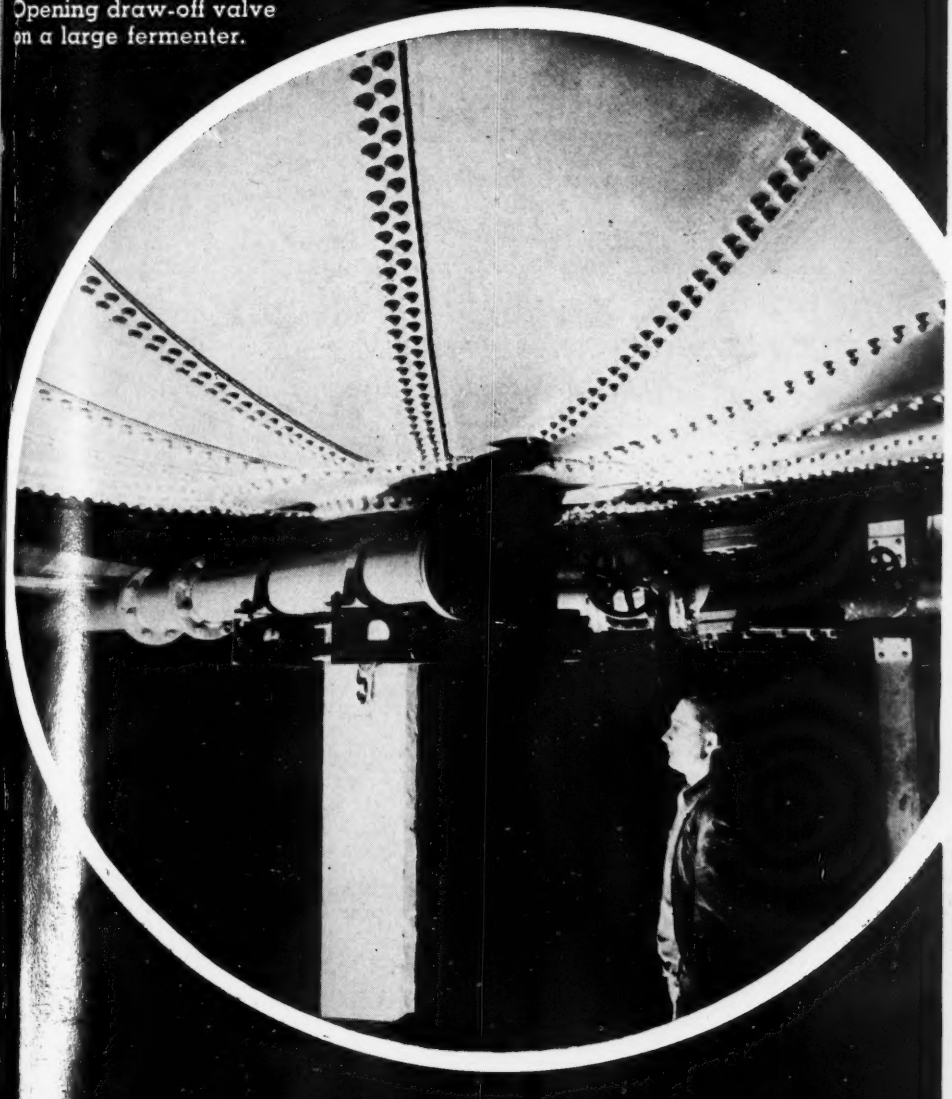
JUL 5 1944

FOOD INDUSTRIES

● FOR THOSE WHO CONTROL QUALITY THROUGH MANAGEMENT AND PRODUCTION



Opening draw-off valve on a large fermenter.

MARCH 1944

Packaging and Storing Dehydrated Food Products

Controlling Air in Packaging Rooms

The Food Comes First in Packaging

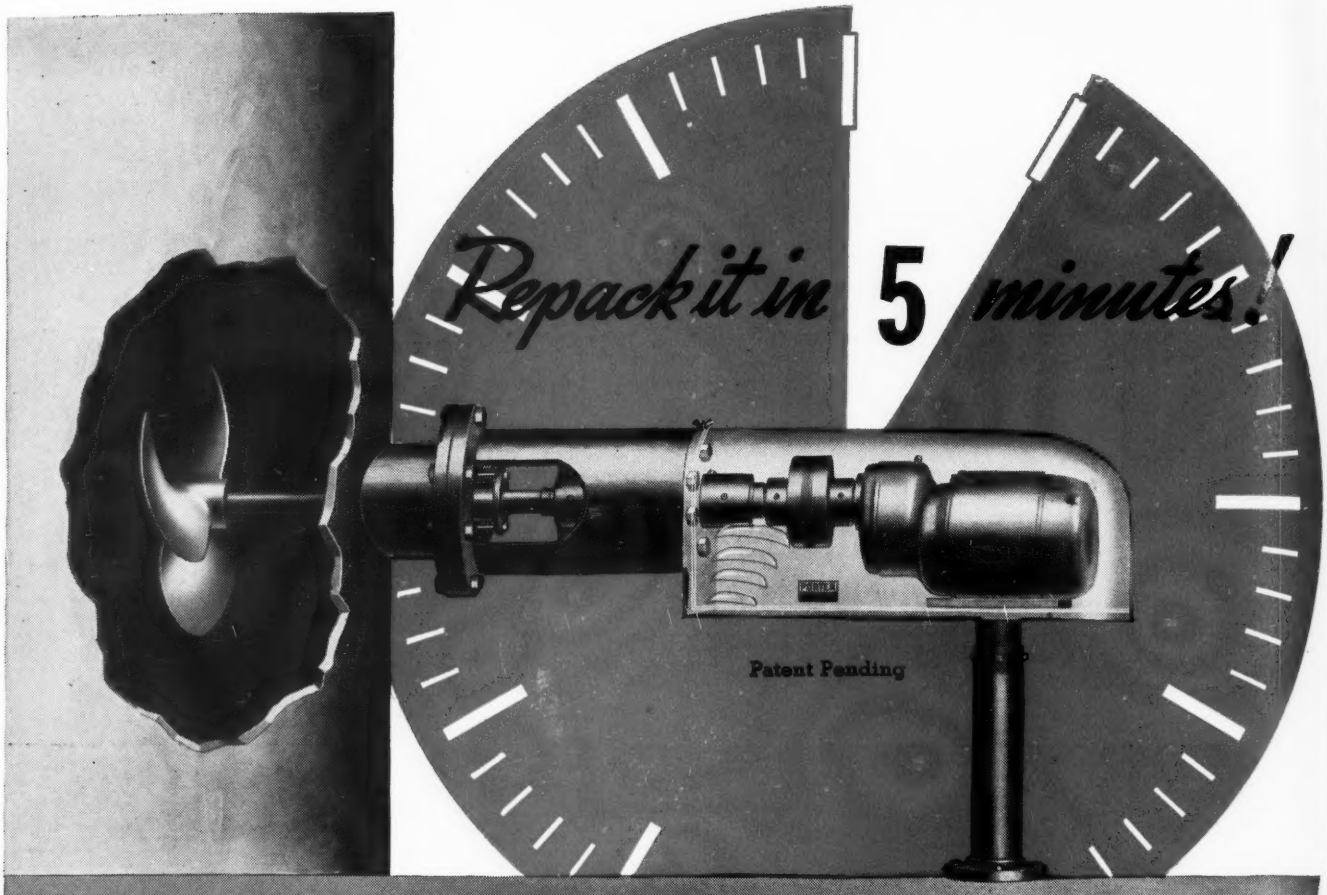
A-B-C's of Coliform Control in Plants

Baker's Enrichment Headaches

Accurate Test for Vitamin A Needed

Protein from Grass

McGRAW-HILL PUBLICATION



THE NEW

PORTER
Side-Entering Mixer

ARMY E NAVY

PORTER *Better Built* Equipment
Established 1866

NEW- *Externally-Accessible Stuffing Box*
Can be repacked *from the outside* without draining tank.

NEW- *Self-Sealing Shaft*
Prevents loss of liquid while repacking stuffing box.

NEW- *Weather-Proof Motor Cover*
Assures all-weather motor protection.

NEW- *Adjustable Motor Support*
Adapts itself to mounting conditions.

Descriptive folder on request

PROCESS EQUIPMENT DIVISION:
Agitators, Mixers, Blenders, Autoclaves, Kettles, Pressure Vessels, Driers, Ball and Pebble Mills.

LOCOMOTIVE DIVISION:
Diesel, Diesel-Electric, Electric, Steam, and Fireless Steam Locomotives.

QUIMBY PUMP DIVISION:
Screw, Rotex, Centrifugal, Chemical, Pumps.

ORDNANCE DIVISION:
Projectiles, Heavy Forgings, Breech Blocks.

H. K. PORTER COMPANY, Inc.
PITTSBURGH, PENNSYLVANIA
FACTORIES:
PITTSBURGH, PA. NEWARK, N. J.
BLAIRSVILLE, PA. NEW BRUNSWICK, N. J.

TECHNOLOGY

BAKING
Bakers' Enrichment Headaches..... 84
CEREAL PRODUCTS
Thiamine Control Test..... 141
Thermophile-free Starch 141
BACTERIOLOGY
Increase in Cell Size..... 141
Sublethal Preheat Assists Germination. 141
A-B-C's of Coliform Control..... 87
STABILIZERS
Emulsion Stability Tested Mechanically 141
DEHYDRATED FOODS
New Facts About Packaging and Storing Dehydrated Foods..... 63
Cabinet Dehydrators Suited to Small-Scale Operations 75
Some Effects of Blanching..... 76
Egg Powder 142
Freezing and Drying..... 142
AIR CONDITIONING
Controlled Air Protects Quality In Food Packaging Rooms 68
PACKAGING
The Food Comes First in Package Design 73
CANNING
Oxygen Free Cans..... 142
FOOD CHEMISTRY
Oxidative Reactions in Carbonated Beverages 143
VITAMINS
Industry Needs Accurate Test for Vitamin A Enrichment 90
MISCELLANEOUS
High-Protein Concentrate Can be Obtained from Grass..... 78
Accelerated Aging 142
Preservative for Fish..... 142

THE COVER

Fermenting tanks come large in the by-products division of Pennsylvania Sugar Co., Philadelphia. The bottom of one is shown on the cover, with a workman opening a valve in the draw-off line. It is used in fermenting molasses to make rum and industrial alcohol.

DISTRICT MANAGERS

NEW YORK 18.....A. G. Sutherland
330 W. 42nd St. Medallion 3-0700
BOSTON 16.....W. Donald Boyd
1427 Statler Bldg. Hubbard 4911
ATLANTA 3.....Ralph Maultsby
1011 Rhodes Haverty Bldg. Walnut 5778
CLEVELAND 15.....Thomas E. Taylor
1510 Hanna Bldg. Main 3981
DETROIT 2.....H. P. Ruprecht
2-144 General Motors Bldg. Madison 6024
CHICAGO 11.....A. E. Del Gado
520 N. Michigan Ave. Whitehall 7900
PHILADELPHIA 2.....Ivan C. Miller
16 S. Broad St. Rittenhouse 0670
ST. LOUIS 1.....G. G. Sears
Paul Brown Bldg. Main 1060
SAN FRANCISCO 4.....J. W. Otterson
68 Post St. Douglas 4600
LOS ANGELES 13.....Roy Phelan
601 W. Fifth St. Michigan 3873

McGRAW-HILL PUBLISHING CO., INC., James H. McGraw, Founder and Honorary Chairman.

PUBLICATION OFFICE: 99-129 North Broadway, Albany 1, N. Y. Return postage guaranteed. EDITORIAL AND EECUTIVE OFFICES: 330 West 42nd St., New York 18, N. Y.

BRANCH OFFICES: 520 North Michigan Ave., Chicago 11; 68 Post St., San Francisco 4; Aldwych House, Aldwych, London, W.C. 2; Washington 4; Philadelphia 2; Cleveland 15; Detroit 2; Los Angeles 13; St. Louis 1; Boston 16; Atlanta 3.

JAMES H. McGRAW, Jr., President; HOWARD EHRLICH, Executive Vice-President; MASON BRITTON, Vice-President; CURTIS W. McGRAW, Vice-President and Treasurer; JOSEPH A. GERARDI, Secretary, and J. S. BLACKBURN, Jr., Director of Circulation.

CABLE ADDRESS: "McGRAW-HILL, N.Y." Member A.B.P. Member A.B.C. Contents indexed monthly in Industrial Arts Index. Copyright, 1944, by McGraw-Hill Publishing Co., Inc.

FOOD INDUSTRIES

M. A. WILLIAMSON, *Publisher* — **LAURENCE V. BURTON, *Editor***

E. S. STATELER, *Associate Editor*, Chicago — G. L. MONTGOMERY, *Associate Editor*

F. K. LAWLER, *Managing Editor* — HILDA G. HOWE, *Art Editor*

C. R. HAVIGHORST, *Assistant Editor*, — GRACE HIGHTOWER, *Assistant Editor*

San Francisco—S. T. Henry, Spruce Pine, N. C.—R. S. McBride and Paul Wooton, Washington, D. C.—Earle Mauldin, Atlanta, Ga.

VOL. 16. No. 3

MARCH, 1944

SPECIAL FEATURE

Postwar Preparations—VIII.....*By L. V. Burton* 61

PACKAGING

New Facts About Packaging and Storing Dehydrated Foods *By Members of Research Staff, Continental Can Co.* 63

Controlled Air Protects Quality in Food Packaging Rooms *By A. A. Giannini* 68

The Food Comes First in Package Design *By Grace Hightower* 73

DEHYDRATED FOODS

Cabinet Dehydraters Suited to Small-Scale Operations—Part III.....*By E. A. Beavens* 75

Some Effects of Blanching.....*By A. S. Crafts* 76

RESEARCH

High-Protein Concentrate Can Be Obtained from Grass *By J. T. Sullivan* 78

PRODUCTION

New Competition for Freezers.....*By W. J. Finnegan* 80

MANAGEMENT

Mobile Shop Keeps More Trucks Rolling..... 82

QUALITY CONTROL

Bakers' Enrichment Headaches....*By William H. Cathcart* 84

A-B-C's of Coliform Control.....*By David Levowitz* 87

Industry Needs Accurate Test for Vitamin A Enrichment *By H. W. Vahlteich and R. H. Neal* 90

EVERY MONTH

Editorials.....61 and 93
Talk of the Industry..... 62
Automotive 82
New Packages and Products 96
Food Industry News..... 101
Indicators 108
OPA Price Regulations... 110
WFA Orders 111
WPB Orders 113
Capital Views 114
Men, Jobs and Companies 117
Food Equipment News.... 121
Catalogs and Bulletins.... 129
Books 130
Patents 132
Food Technology — Abstracts 141
Questions and Answers.. 144
Formulas 147

For permanent protection...

METALAM

DOBECKMUN SPECIALTIES

Package design—the right combination of material, shape and design to provide protection, attractiveness and utility.

Cellophane bags—from ounces to gallons; printed or plain; single or duplex; flats, squares or satchels.

"Tritect" cellophane — wax-laminated film for extra protection, in rolls, sheets or bags.

"Metalam"—pure metal permanently bonded to tough acetate film, to give your product positive protection.

Printed films and foils — in sheets and rolls.

Laboratory testing — complete facilities for pretesting packages under all conditions of climate and service, to insure the right answer in advance.

TO answer the demand for complete protection for hygroscopic products, Dobeckmun created some years ago a new, flexible, heat-sealed, laminated aluminum foil. Now, looking forward to the time when aluminum foil and suitable films may become available for commercial use, we are giving this new and outstanding material a new name—METALAM.

Metalam is pure metal, permanently reinforced by acetate. The metal barrier is impervious to moisture. The transparent acetate supports the foil and permits attractive, multicolor printing on the package.

Countless tons of Army instant coffee and dehydrated lemon drink products have been permanently sealed in Metalam. Even effervescent powders have been shipped to the Tropics with perfect safety. Any "intolerant" product that must be held to a fixed moisture content receives complete and permanent protection in Metalam.

When aluminum and the necessary films become noncritical materials, you will be able to obtain Metalam in rolls for automatic packaging or in sheet and bag forms. To give your product positive protection—plan on Metalam.

CONVERTERS—PRINTERS—LAMINATORS of films and foils

THE DOBECKMUN COMPANY

CLEVELAND 13, OHIO

WESTERN SALES HEADQUARTERS • SAN FRANCISCO

FOOD INDUSTRIES is published monthly. Price 35c per copy. Allow at least ten days for change of address. Publication Office, 99-129 North Broadway, Albany, N. Y. All communications about subscriptions should be addressed to the Director of Circulation, Food Industries, 330 West 42nd St., New York 18, N. Y. Subscription rates: United States and Possessions, Mexico, Central and South American countries, $3 a year, $4 for two years, $5 for three years. Canada, $3.50 a year; $5 for two years; $6 for three years (payable in Canadian or U. S. Funds). Great Britain and British possessions, 30 shillings for one year, 60 shillings for three years. All other countries, $5 a year, $8 for two years, $10 for three years. Entered as second-class matter, Aug. 17, 1936, at Post Office, Albany, N. Y., under the act of March 3, 1879.

Disposal of Government Inventories

How to dispose of government surpluses when the war ends need not be an insuperable problem – if we face it promptly and intelligently. But if we do not, peacetime markets may be disrupted, government funds wasted, production discouraged, and reconversion of the whole economy to peace seriously hampered.

What we need most in order to attack the problem is estimates of how much surplus there will be, in what types of goods, and where.

At the war's end, government inventory of war goods is likely to total around 60 billion dollars. Most of this will consist of aircraft, ships, and other ordnance. Only some 15 billion dollars or less will be in food, clothing, trucks, tools, chemicals, medical supplies, transportation, engineering and communication equipment, and other goods for which there is a civilian market.

In addition, war contractors will have about 10 billion dollars of inventories, the bulk in specialized raw materials, goods in process, and finished products. Only about one-fifth of the total, or some 2 billion dollars, will be marketable or usable for civilian purposes. While the government takes over the usable inventory, the ex-war-contractors will have to build up their stocks for peacetime production, so that on balance, they will not be disposing of usable inventories in large volume.

Not even all of the usable war-end inventory will be "surplus" for sale to civilians in competition with new production. Some of it will be needed by the sizable peacetime Army and Navy we are likely to maintain, and such additional items as can be stored without serious deterioration or obsolescence will be held against possible future war emergencies. Some of it will be disposed of abroad. And up to half of it will be abroad and may be sold there or used for relief.

After allowing for these factors, the war supplies to be disposed of in our own markets probably will be less than 10 billion dollars (cost basis). While the total is not overwhelming – the equivalent of two months' retail sales – in certain lines the surplus will be several years', instead of a few months', normal supply. In particular, the volume of scrap metals available from otherwise unusable munitions will present a problem.

A great deal can be done now to reduce the size of the postwar surpluses by achieving a better balance between military needs and supplies and avoiding excessive inventories of particular raw materials or finished goods. This work needs to be pressed, not only to simplify our transition to peace but also to prevent wasting productive energies during the war. Furthermore, when the war ends on one front, inventories of war materiel should be worked down to the reduced scale of remaining military activity.

We cannot develop programs of action until we know approximately how much of each type of item is to be sold, and where and when it will be available. Wide margins of error are inevitable as long as large-scale procurement and large-scale consumption are still taking place; yet such information is essential and must be developed. Indeed, improved inventory records and estimates are badly needed for the conduct of the war as well as for managing the surpluses after hostilities cease.

In decisions on the disposal of war-goods inventories, the public interest must be the prime consideration. Proposals that none of these goods should be sold domestically because of competition with new production obviously are untenable. Everything that is not needed by the Armed Services or for other special purposes should be disposed of ultimately. The real problem is not whether surpluses should be sold, but rather to whom, at what price, and at what time the sale should be effected.

In the distribution of such large quantities of goods, we believe that established trade channels should be used wherever possible. Otherwise, we shall witness widespread speculation in war goods and the mushroom growth of inefficient and disruptive fly-by-night distributors. This will benefit only a few speculators and will discourage legitimate producers and distributors from making their normal commitments.

All war contractors should have the privilege of retaining those inventories for which they are willing to pay actual cost or a fair price negotiated with the gov-

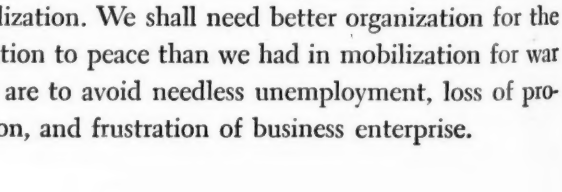
ernment procurement agency. The balance of the inventories in the hands of war producers should be assembled by the government and sold in an organized manner. It is of great importance that the plants be cleared of these inventories at once so that the process of conversion to peacetime operation can proceed without further delay. To accomplish this, preparations must be made before the end of the war for speedy determination of the inventories to be moved and for a huge volume of storage space to accommodate them.

The price which can be realized and the timing of sale are closely related. Certainly the best prices will not be secured if the government attempts to dispose of large supplies of material and products suddenly without regard to market conditions. Most businessmen rightly favor an early transfer of surplus inventories from government to private ownership. But, they also realize that if all the surpluses are dumped indiscriminately as they become available, many markets will be badly depressed, and the resulting low prices will bring lower production. If this depression effect becomes general, as it easily can, it will be costly to the nation in terms of jobs, income, and goods.

In industries in which production is inadequate to meet postwar demands, an immediate sale of government inventories can prevent inflated prices and preserve balanced market conditions. In cases in which the surpluses are large in relation to annual production, the disposition can be scheduled over a period of years. Generally, however, it will be best to clear the surpluses as quickly as orderly sale can be accomplished rather than to leave them as a continuing threat overhanging the market. Most industries can, and should, take the disposal process in their stride without special dispensations from the government. In this connection, it should be noted that the tax provisions for carry-back of losses and excess profit credits after the war greatly increase the possibilities for speedy disposal of surpluses without serious injury to producers.

There will be some industries, however, in which the postwar surplus is so large that it would practically saturate the market for years to come. The problem of these industries is further complicated by their wartime expansion of capacity many fold in excess of peacetime requirements. These lines of production are, moreover, crucial for our national defense. Aircraft and shipbuilding are cases in point. Each of these situations calls for careful study and discussion by all concerned to devise means to keep alive the necessary production organizations, the research effort, and the spirit of enterprise. Insofar as possible, the individual manufacturers should work out their own salvation in the conversion to peacetime markets. They can do this by taking on new lines, by increasing their production efficiency, and by developing technical improvements which make the existing inventories obsolete. But they still will need some kind of government protection or assistance while the huge surpluses are being worked off. It is most important, however, that such protection or subsidy be limited to a period of three to five years. It must not become permanent unless it is really essential for our national security.

The disposal of surplus inventories is part of the whole process of demobilization of the war effort and conversion to peace. If this process is to be accomplished with minimum dislocation and injury to our economy, it will have to be directed by a central agency which has developed adequate information service and is in position to coordinate the policies of the Armed Services and the other interested executive branches of the government. This agency should draw freely on the knowledge of businessmen in the specialized problems of marketing surpluses in each industry. It should formulate definite programs of inventory disposal for all industries in which the problem is acute; and it should make these programs public as soon as possible, so that business can plan for the future with confidence. In large measure, the success with which we make the economic transition to peace will depend on the quality of government administration in the process of industrial demobilization. We shall need better organization for the transition to peace than we had in mobilization for war if we are to avoid needless unemployment, loss of production, and frustration of business enterprise.



President, McGraw-Hill Publishing Company, Inc.

Postwar Preparations—VIII

The Time Factor in Business Strategy

QUITE a number of communications have come to this office from readers who counsel that I talk less about postwar preparations and more about winning the war. Some of these come in the category of brickbats, with which I must confess considerable experience—both on sending and receiving. Others are friendly admonitions.

All right, let's win the war.

Then what do we do next? Not only what do we do, but when do we do it? How do we do it? And why do we do it? Also how long does it take to get ready to do it?

Directors Must Be Sold

And after all our plans are made at the management level of authority, there are plenty of further tasks to be completed before the plans can be translated into preparations. The bulk of our readers are not corporation presidents nor members of the board of directors, and consequently seldom know about the problems of securing approval by the board for major aggressive moves that may require considerable sums of money. The job of a corporation head is generally difficult, for unless he owns a majority of the shares in his company he is between his subordinates and his board. Big corporations in the food processing industry usually number a substantial group of capable higher employees on the board, but smaller ones are generally afflicted with directors who know next to nothing about their own business and very little about business in general. They are acutely dividend-conscious, imbued with a sublime disregard for tomorrow's problems that are already discernible today. Like one $400,000 company which had one man and five widows on the board.

Directors are human beings. They have to be sold new ideas. As custodians of the property of the stockholders they have a moral and legal obligation to debate and examine the proposals placed before them prior to granting approval for their execution. All this takes time. And generally speaking, the fewer the members of the board with considerable business experience in manufacturing, the longer it takes to reach a decision.

Business that is operated on a short-range policy, where management never looks ahead nor really plans for the future, is not the happiest place to work. I introduce this thought right here because, of all the admonitions to "Let's win the war" and to defer all thought of postwar preparations until the shooting is over, not one has come from men at the top.

Forward thinking is a normal requirement of management. Any manager who does not habitually think and plan forward does not remain a manager very long after the first big crisis. And conversely, any man who ever hopes to advance in this world must habituate himself to thinking, planning and preparation for what is ahead. If he does not come up every now and then with a well-thought-out and sound idea for aggressive forward action, he surely will be passed by.

Forward planning being an indispensable function of management at all times, war or no war, there is no good reason for stopping forward planning until after the Allied armed forces have killed enough Germans and Japs to convince the survivors that crime does not pay. It so happens that the problems of forward planning in the manufacture of foods, as well as in many other industries, are more acute with the nearing of the end of the greatest war in all history than was the case of forward planning in the days of the "Long Armistice." They are so much more acute than ordinary planning that most of us designate them as postwar plans or preparations. One well-managed corporation will not permit any employee to talk about postwar planning lest the men get into the bad habit of unconsciously thinking that forward planning can stop when the war is over.

Applying Strategy to Business

I counsel that we vigorously maintain our war efforts. The war comes first. But let us draw a parallel between the conduct of the war and what business management should be doing. If you have been following the war news closely you have read of strategic air forces and tactical air forces. Both types utilize pretty much the same sort of equipment and flyers. But they have different jobs to perform.

Tactics is the art of winning a battle; strategy is the art of making battles win a war. In warfare the strategic air force does the things, during and in advance of a battle, that the commander of the tactical forces in that battle would presently wish had been done before his troops were in heavy combat—such things as knocking out bridges a hundred miles behind the enemy over which his supplies and reserves must come up, or destroying his supplies, ammunition dumps or factories.

Postwar preparations are the current strategy of business. They insure future service to humanity and jobs for employees by virtue of having done in advance the things that will be needed to make a business successful. Men who win wars or make businesses succeed do not leave things to chance.

L. V. Burton EDITOR

The Talk of the Industry

• WE do not approve of wordy mouthings about what the United States is going to do to the Japs, such as certain senators, who announced, on the day after the fall of Corregidor, that we would take the Philippines back when we get ready, or the more recent public remarks by the Congressman who is going to wipe Tokyo off the earth. Bluster is not called for. What we need is a cold, silent fury that will carry on until the handful of Japs that survive this war will wish they had never been born.

It is likely that the Jap, himself, is less impressed by typical U. S. overstatement than British understatement. In war, as in public relations, it is deeds, not words, that count.

• IT'S rare indeed when a bacteriologist makes news except in the medical field. Therefore it is deserving of comment that William H. Marcussen, newly elected vice-president of The Borden Co., started out as a bacteriologist.

• RED RATION STAMPS for waste fat have produced far more results than money alone. Retail grocers in the East say that apparently the average housewife won't bother with carrying a can of fat for a few cents, but for red stamps—ah, that's different.

• A SUBSCRIBER has protested our attitude against subsidies on the ground that this publication is opposed to the interests of the consumer.

We are not opposed to the interests of the consumer, never have been and never will be, unless our belief that the consumer is not entitled to his food below cost can be construed as opposition to his interests. We believe that everybody should pay for his food and everything else that is produced or delivered to him by the work of others.

If there are any other readers who are all hot for subsidies, we should like to pose this question: Is it in the interest of the consumer to postpone paying for today's food until tomorrow when his income is likely to be smaller?

Save paper.

Conserve paper.

Collect scrap paper.

There is no available substitute for paper.

• BACKSTAIRS GOSSIP has it that one of the bones of contention, leading to many past resignations in the Office of Foreign Relief and Rehabilitation under Governor Lehman, is the stockpiling policy. Many of those who quit had insisted that OFRR should begin now to accumulate food reserves for our share of UNRRA's work. Roy Hendrickson, then head of the Food Distribution Administration, is alleged to have opposed this action on the ground that there would be plenty of food available after invasion. The others then quit.

Mr. Hendrickson is now one of the top men in UNRRA. But about Christmas time, Director-General H. H. Lehman testified before the House Foreign Affairs Committee that stockpiles are urgently needed.

• "IF I understood Vice-President H. A. Wallace's thinking correctly," said a prominent industrialist to this department, "it works out this way: Should Britain and the Netherlands choose to sell us rubber at 10 cents a pound in the postwar period, Mr. Wallace would consider this as not consistent with the good neighbor policy and would insist on paying 20 or 30 cents a pound.

Hors d'Oeuvres

• Cakes have been examined to determine their vitamin and mineral content. Won't the nutritionists leave us just one food that we can eat for no better reason than that we happen to like it.

• *Confectioners find there is more profit on the same amount of raw material when made into bulk candy than when made into five-cent bars. So you know why the shortage of candy bars. But don't complain. You'd do the same thing.*

• Know what are "popoffs"? They're a new experimental variety of sweet pepper so high in sugar content that they can be eaten raw like uncooked fruit.—The pepper progresses as thyme marches on. (Well, hell, there's no law against being silly.)

• *Chester Bowles puts the cost of OPA operations at a little more than one dollar a year per citizen. Considering what you didn't spend for the food OPA wouldn't let you buy, you are deeply indebted to that agency. So stop bellyaching.*

• A Federal court has ruled that popcorn mixed with mineral oil is not adulterated. But it's most certainly abominated.

• *A manufacturer is charged with making candied fruit principally from the rinds of grapefruit discarded by a Naval station and training center. He took to heart the assertion that a lot of food is wasted in the garbage cans of America.*

• An old institution of the Prohibition era has been revived in St. Louis—*heim gomach.* In English, home brew is back. Though bad news for brewers, it has tripled the local demand for malt sirup in a year. It's an ill beer that brews no good.

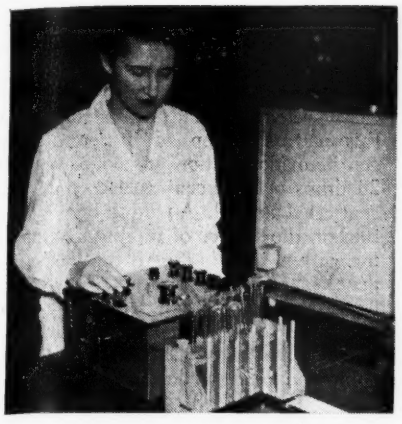
• *Thirty thousand tons of fresh Mexican onions will be imported for the Army. Which makes the onion dehydrators weep.*

• Marine fighter pilots carry bottles of beer in the cockpits of their Corsairs while they move the decimal point to the left of a few more Zeros. The beer gets cold at the high altitudes and makes a refreshing relaxer after the pilots land. Nothing, not even warm beer, stumps the U. S. Marines.

• *A survey shows that the women of Canada, Australia and the United States are considerably more in favor of a dry law than are the men. Can there be no single standard?*

• After one of General Vatutin's swift advances in Russia, his men dined on bread baked from dough that had been kneaded by the disposed Wehrmacht bakers. Does the Russian Army roll? Your darn Vatutin!

• *People are now eating shark steaks, carp fillets, smoked buffalofish, mussel chowder, squid, whaleburger and dozens of other unfamiliar foods. People had gotten in a dietary rut with their juicy prewar steaks—but it was a rather nice rut.* F.K.L.



Worker in Continental Can Co. research laboratories tests dehydrated foods for vitamin content by photometric method.

Taste-testing apple sauce made from apple nuggets (crisps). The findings relative to this product are reported in Part II.

Powdered dehydrated cranberries in 3-ply heat-sealing bag in a small 3-in-1 carton and in No. 1 tinplate cans.

New Facts About Packaging And Storing Dehydrated Food

By MEMBERS OF THE RESEARCH STAFF, Research Laboratories, Continental Can Co., Chicago, Ill.

Too little is known about the technical factors which affect the packaging and storage of dehydrated foods. To supply this data, Continental Can Co. has made a series of studies. The findings will be reported in "Food Industries," and two installments follow. More are coming later

PART I—INTRODUCTION AND PROCEDURE OUTLINED

ALTHOUGH the pressure of war needs has expanded the dehydrating of foods into a commercial activity of major importance, industrial research pertaining to dehydrated foods had not kept pace with their production. As a result, information on their storage characteristics and packaging requirements has been very limited.

With this deficiency in mind, the Continental Can Co.'s research department has prepared and studied a series of experimental packs of dehydrated fruits and vegetables. The incentive for the study was that the data obtained would be of benefit to both the processors and to the government agencies purchasing dehydrated foods.

The specific objectives of the program were to determine the effect of (1) packaging, (2) storage time, (3) storage temperatures and (4), in some cases, moisture contents lower than specified on the keeping and eating quality and vitamin content of the selected fruits and vegetables. Selection was made from those commodities purchased in greatest quantities by the government during 1942 and 1943 and recommended for study by the QMC Subsistence Research and Development Laboratory. Those selected are:

1. Apple nuggets
2. Beets
3. Cabbage
4. Carrots
5. Cranberries
6. Hominy
7. Onions
8. Rutabagas
9. Sweet potatoes
10. Tomato flakes
11. Tomato juice cocktail
12. White potatoes

The experimental packs were started on October 25, 1942, with powdered dehydrated cranberries; most of the other packs followed soon afterwards.

As the studies were being planned and started the following fundamental procedure was set up:

1. All samples were to be taken during regular commercial dehydrating operations.
2. All samples were to be representative of the listed products as offered for sale to the U. S. Army and the Federal Surplus Commodity Corp.
3. Complete history was to be obtained of each sample, including the variety of fruit or vegetable, general growing conditions, blanching time, dehydrating temperature and other pertinent data wherever possible.
4. Although only small samples would be practicable for handling in the laboratory, they were to be packaged so that the results obtained might be interpreted in terms of commercial large-size packages.
5. All samples were to be as fresh as possible when packaged and storage studies begun.

Packages chosen for the studies were:

1. No. 1 tinplate can, hermetically sealed in air.
2. No. 1 tinplate can, hermetically sealed in nitrogen to have a residual oxygen content similar to that normally obtained in regular commercial gas-packing operations.
3. No. 1 tinplate can, hermetically sealed in CO_2, and, as in the case of nitrogen, having a practical oxygen content.
4. Carton, $2\frac{3}{4}$ in. x $1\frac{3}{8}$ in. x $4\frac{1}{16}$ in. plus an inner bag, heat sealed in air; miniature equivalent of the 3-in-1 container specified by the Q.M.C. as a substitute container for the products under test.

The inner bags, which have the approximate capacity of a 211x400 can, were specially manufactured by the Reynolds Metals Co. They are 3-ply bags of which the outer ply is a No. 1 kraft 40-lb. paper laminated to a middle ply of 0.00055-in. lead foil. The inner ply is of 0.009-in. regenerated cellulose, coated on both surfaces with

a thermoplastic adhesive, and heat-sealed to the lead foil. The bag is formed by folding a sheet of the 3-ply material, 5x14 in., to give a 5x7-in. envelope. The two long sides are heat-sealed before filling. After filling the closure is completed by heat-sealing. For convenience in handling, the bags were inserted in small, finished 0.020-in. chipboard cartons with both ends partially sealed with Scotch tape.

The filling and sealing of all these paper packages were supervised by a representative of the Reynolds Metals Co. to assure proper handling.

Approximately 50 packages of each of the four types of package were filled with each dehydrated product studied.

All cans were closed on laboratory instead of commercial equipment. In the course of each examination, the cans were tested for leakage to determine the effectiveness of the seals.

These particular packages were chosen so that a comparison could be had between air and gas packing and between hermetic sealing in a rigid metal container and in a substitute paper container. The first comparison, of course, would determine the effect of the presence of oxygen on the storage characteristics of the products, and the second comparison would determine the amount of moisture which would be absorbed by these products in the substitute package. The products were gas-packed rather than vacuum-packed to eliminate oxygen because of the impracticability of sealing large commercial packages under vacuum.

The storage studies were to be carried out over a period of at least one year; possibly two years if the results warranted. Samples of each product were divided between storage at 130 deg. F., 98 deg. F. and ordinary room temperature (75 to 80 deg. F.). The substitute paper packages stored at 98 deg. F. were also subjected to an atmosphere having a relative humidity of 93 percent. This humidity was maintained in a closed chamber by a saturated solution of mono-ammonium phosphate.

For each experimental pack, the filled cartons were weighed at the beginning of the storage period and again at monthly intervals thereafter. This gain in weight, corrected for the amount of moisture absorbed by the paper in the cartons as well as the change in moisture content of the product packed in these packages, is shown in tables which are a part of the report on each specific product.

Because of the extent of work involved, only single samples of each package were opened.

The following quality and nutritive factors were determined by the methods indicated at each examination over the period of study:

1. Flavor was rated on a scale from 1 to 10, on which 10 is the best and 1 the poorest rating. A rating of 6 on this scale represents a product just barely passable. This is the same type of scale used for evaluating the flavor quality of dried whole eggs. A panel of six tasters was developed for flavor ratings. At least four of these tasters were present at each examination.

2. Color was evaluated in numerical terms by the use of Munsell color disks. The results were reported in terms of the percentage of each color disk required to duplicate as closely as practical the color of the sample being examined. The Munsell notation for each disk used is indicated in the data tables. In some cases the color of the samples could not be matched accurately enough with the disks on hand to warrant presenting the data in the tables. All in all, the data on color is intended only for the purpose of indicating trends of color change rather than serving as an accurate notation of the colors encountered at each examination.

3. Reconstitution: At the first examination of each product, an attempt was made to develop the optimum practicable reconstitution and cooking schedule for it. In the case of most of the products, except those received in powder or flake form, the relative ability of the product to reconstitute was measured by determining its drained weight. The method used consisted of cooking a 10-gram sample for a predetermined time, draining for 2 minutes on a standard 8-mesh sieve, and weighing the drained product. The drained weights are reported in grams of reconstituted cooked product.

4. Gas analyses were made using the Van Slyke manometric method. The amounts of oxygen and CO_2 present in the cans were determined and reported as percentages of the total.

5. Moisture contents were determined by the use of a modification of the A.O.A.C. method. This consists of determining the loss in weight occurring when a 2-gram sample, ground so that it will just pass through a standard 30-mesh sieve, is held in a vacuum oven operating at exactly 70 deg. C. and approximately 100 mm. Hg. (or less) absolute pressure, for exactly 5 hours.

6. Enzyme activity: In the case of most of the vegetables, the Army specifications call for the inactivation of the peroxidase system. In the case of cabbage, they call for the inactivation of catalase. For determining peroxidase activity, 2½ grams of the dehydrated product was placed in 50 c.c. of water and held for 15 minutes. To this mixture 2 drops of 30 percent hydrogen peroxide solution was added and then 20 drops of 1 percent guaiacol in 95 percent ethyl alcohol. A reddish-brown coloration on the surface of the product, appearing within 15 minutes, is regarded as evidence of peroxidase activity. This test was repeated for each product, adding 1 percent benzidine in 95 percent ethyl alcohol in place of the guaiacol. In this case, a blue coloration is regarded as evidence of peroxidase activity. In all cases, the method was checked for accuracy by using the same procedure on a sample which had been boiled for 1 hour. For a test to be considered accurate, the results of the check on this boiled control must be negative.

7. Ascorbic acid (vitamin C) was determined by the rapid photometric method as described by Morell (*Industrial and Engineering Chemistry*, Analytical Edition, vol., 13, 793, 1941).

8. Carotene (provitamin A) was determined by the method of L. A. Moore (*Industrial and Engineering Chemistry*, Analytical Edition, vol. 12, 726, 1940).

9. Thiamine hydrochloride (vitamin B_1) was determined by the Conner and Straub modifications of the Hennessy and Cerecedo method (*Industrial and Engineering Chemistry*, Analytical Edition, vol. 13, 380, 1941).

10. Riboflavin (vitamin B_2) was determined by the microbiological method of Snell and Strong (*Industrial and Engineering Chemistry*, Analytical Edition, vol. 11, 346, 1939).

The results of the above examinations and evaluations are shown in tables which are a part of the report on each specific product. The trends of change in flavor, in composition of the atmosphere in the cans and in vitamin contents are shown on graphs which also are a part of the report on each product.

The evaluations of the foods as excellent, good, fair or poor sources of the vitamins are based upon the system recommended by the Council on Foods of the American Medical Association in "Accepted Foods and Their Nutritional Significance," American Medical Association, p. 16, 1939.

PART II—APPLE NUGGETS (CRISPS)

IN the course of studying apple nuggets during a storage period of a year, these conclusions are drawn:

1. Apple nuggets, when reconstituted to make apple sauce, is a highly acceptable food product. Apple sauce made from it, in our opinion, was comparable to that made from whole apples as ordinarily purchased. The nuggets are, however, a poor source of thiamine (vitamin B_1) and riboflavin (vitamin B_2) and only a fair source of ascorbic acid (vitamin C).

2. The approximate original odor, flavor and color can be preserved with very little change, provided that the product is held in an atmosphere essentially free from oxygen and is not subjected to temperatures appreciably above 80 deg. F. for more than a few months.

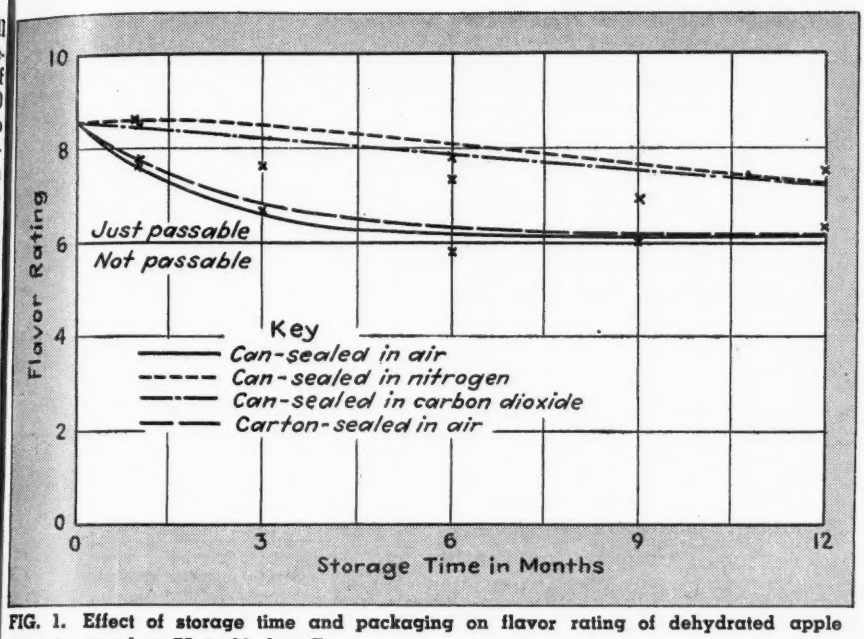


FIG. 1. Effect of storage time and packaging on flavor rating of dehydrated apple nuggets stored at 75 to 80 deg. F.

3. Storage at high temperatures (approximately 130 deg. F.) soon reduces the overall quality of this product and within a few months makes it inedible. The product is, however, fairly stable at temperatures around 100 deg. F.

The Chicago Quartermaster Depot and the Appella Corp.'s Midwestern representative helped us secure the dehydrated apple nuggets for this experimental pack. It was impossible to determine just when this product was dehydrated. It was prepared some time during the fall of 1942. It is probably safe to assume that the dehydrating took place no longer than about one month before the experimental pack was made. The material was dehydrated at the Selah, Wash., plant of the Appella Corp.

Because a blend of several varieties of apples is ordinarily used in the manufacture of this product, and because the actual combination of varieties varies

TABLE I—Results of Examinations of Apple Nuggets (Crisps).
Storage at 75 to 80 deg. F. (room temperature)

Storage time	Package	Flavor rating	Color (dry product) % N-1 (black)	% 5 yr. 6/12 (orange)	% 5 yr. 4/14 (yellow)	% N-9.5 (white)	Vitamin content (mg./100 gm.) Thiamine	Riboflavin	Ascorbic acid Reduced	Total	Gas analyses % O_2	% CO_2
	Moisture content of product—0.8 percent											
Initial examinations	Can—air	8.5	..	..	..	..	0.078	0.104	12	19	....	....
	Can—N_2	8.5	..	..	..	..	0.077	0.094	12	30	0.3	1.0
	Can—CO_2	8.5	..	..	..	..	0.091	0.124	9	21	0.8	96.4
	Carton	8.5	..	..	..	..	0.073	0.123	15	26	....	....
1 month	Can—air	7.6	..	..	..	..	0.074	0.128	13	21	....	....
	Can—N_2	8.6	..	..	..	..	0.070	0.131	12	21	....	....
	Can—CO_2	8.5	..	..	..	..	0.062	0.142	12	29	....	....
	Carton	7.7	..	..	..	..	0.070	0.138	11	26	....	....
3 months	Can—air	6.7	43	33	12	11	.....	.....	..	..	....	....
	Can—N_2	8.2	43	33	12	11	.....	.....	..	..	....	....
	Can—CO_2	8.2	41	33	14	11	.....	.....	..	..	....	....
	Carton	7.6	41	33	14	11	.....	.....	..	..	....	....
6 months	Can—air	5.8	49	29	13	9	0.054	0.112	11	19	20.4	0.2
	Can—N_2	7.3	50	28	13	9	0.055	0.123	9	22	0.3	0.0
	Can—CO_2	7.8	47	29	13	11	0.059	0.115	10	20	0.9	96.3
	Carton	6.1	56	24	11	9	0.052	0.109	10	19	....	....
9 months	Can—air	6.0	36	40	12	12	0.057	.....	8	16	....	....
	Can—N_2	6.9	36	41	12	11	0.058	.....	9	24	....	....
	Can—CO_2	7.6	33	41	15	11	0.059	.....	9	23	....	....
	Carton	6.3	23	51	12	13	0.062	.....	9	18	....	....
12 months	Can—air	6.3	37	43	12	8	0.055	0.129	7	14	14.0	0.4
	Can—N_2	7.5	37	43	12	8	0.056	0.124	7	18	0.6	0.2
	Can—CO_2	7.4	34	47	12	7	0.052	0.130	11	20	0.6	98.0
	Carton	6.1	32	40	11	7	0.053	9.133	10	19	....	....

When the samples were examined for odor after 1 month and again after 6 months of storage, there was a definite difference between them. There was little difference between the two gas-packed samples at these examinations. Both were described as having a pleasing apple odor. However, the samples sealed in air had a slight "straw" or "hay-like" odor after 1 month. After 6 months of storage, this off-odor had become quite definite in the sample in the air-packed can, while it was even more noticeable in the sample stored in the carton.

TABLE II—Results of Examinations of Apple Nuggets (Crisps).
Storage at 98 deg. F.

Storage time	Package	Flavor rating	Color (dry product) % N-1 (black)	% 5 yr. 6/12 (orange)	% 5 yr. 4/14 (yellow)	% N-9.5 (white)	Vitamin content (mg./100 gm.) Thiamine	Riboflavin	Ascorbic acid Reduced	Total	Gas analyses % O_2	% CO_2
	Moisture content of product—0.8 percent											
Initial examination	Can—air	8.5	..	..	..	..	0.078	0.104	12	19	..	....
	Can—N_2	8.5	..	..	..	..	0.077	0.097	12	30	0.3	1.0
	Can—CO_2	8.5	..	..	..	..	0.071	0.124	9	21	0.8	96.4
	Carton	8.5	..	..	..	..	0.073	0.123	15	26	....	....
1 month	Can—air	7.6	..	..	..	..	0.069	0.127	8	14	....	....
	Can—N_2	8.1	..	..	..	..	0.065	0.121	7	17	....	....
	Can—CO_2	8.0	..	..	..	..	0.068	0.125	7	23	....	....
	Carton	7.4	..	..	..	..	0.071	0.124	9	16	....	....
3 months	Can—air	6.3	46	36	9	8	.....	.....	..	..	20.4	0.3
	Can—N_2	....	..	..	..	..	.....	.....	..	..	....	....
	Can—CO_2	7.5	45	35	10	9	.....	.....	..	..	0.6	96.9
	Carton	6.1	44	37	8	10	.....	.....	..	..	....	....
6 months	Can—air	5.8	59	29	6	6	0.043	0.111	8	18	20.0	0.3
	Can—N_2	6.9	54	27	8	11	0.041	0.112	8	19	0.4	0.3
	Can—CO_2	6.7	55	29	8	7	0.035	0.113	9	19	0.6	96.7
	Carton	5.3	57	31	5	6	0.051	0.123	0	15	....	....
9 months	Can—air	6.3	39	44	9	8	0.055	.....	8	11	16.4	0.6
	Can—N_2**	....	..	..	..	..	.....	.....	..	..	....	....
	Can—CO_2	6.2	42	43	7	8	.....	.....	8	18	2.8	95.1
	Carton	4.2	59	33	4	4	0.048	.....	3	10	....	....

Odor tests after 1 month and 6 months of storage indicated that there was a definite difference between the gas packed samples and those sealed in air. The former samples had a typical apple odor, while the latter had a definite "straw" or "haylike" odor. In this respect there was no appreciable difference between the two gas-packed samples nor between the samples sealed in air.

**These cans leaked because of a faulty closure on the laboratory equipment used.

TABLE III—Results of Examinations of Apple Nuggets (Crisps).
Storage at 130 deg. F.

Storage time	Package	Flavor rating	Color (dry product) % N-1 (black)	% 5 yr. 6/12 (orange)	% 5 yr. 4/14 (yellow)	% N-9.5 (white)	Vitamin content (mg./100 gm.) Thiamine	Riboflavin	Ascorbic acid Reduced	Total	Gas analyses % O_2	% CO_2
	Moisture content of product—0.8 percent											
Initial examination	Can—air	8.5	..	..	..	..	0.078	0.104	12	19	....	....
	Can—N_2	8.5	..	..	..	..	0.077	0.095	12	30	0.3	1.0
	Can—CO_2	8.5	..	..	..	..	0.071	0.124	9	21	0.8	96.4
	Carton	8.5	..	..	..	..	0.073	0.123	15	26	...	....
1 month	Can—air	7.0	..	..	..	..	0.064	0.147	6	23	....	....
	Can—N_2	7.5	..	..	..	..	0.063	0.146	6	16	....	....
	Can—CO_2	6.6	..	..	..	..	0.063	0.144	5	21	....	....
	Carton	7.2	..	..	..	..	0.061	0.137	5	20	....	....
2 months	Can—air	2.0	71	27	..	1	0.061	.....	..	..	17.1	3.9
	Can—N_2	2.5	76	22	..	1	0.057	0.150	..	..	0.4	3.3
	Can—CO_2**	...	...	...	..	..	.....	.....	..	..	....	....
	Carton	2.5	70	29	..	1	0.060	.....	..	..	....	....
3 months	Can—air**	...	..	..	..	..	.....	.....	..	..	....	..
	Can—N_2	Inedible	78	20	1	..	.....	.....	..	..	0.4	4.8
	Can—CO_2	Inedible	75	22	..	2	.....	.....	..	..	0.7	95.7
	Carton	Inedible	80	17	1	..	.....	.....	..	..	....	....

**These cans leaked because of faulty closure on the laboratory equipment used.

during the season, it is impossible to determine just what varieties of apples were used in dehydrating the particular material received. The varieties used by the Appella Corp. are Jonathan, Delicious, Winesap, Rome and Yellow Newton, all grown in the Northwest. The apples are peeled and cored, then thoroughly washed, inspected, sliced and predried by tunnel drying to a moisture content of approximately 20 percent. Immediately prior to this predrying, the apples are sulphured, in a manner similar to the procedure ordinarily used in the production of evaporated apples. After predrying, the apples are ground into small particles and then dried to a moisture content of approximately 2 percent by a patented vacuum process at a temperature below the caramelization point of the sugars present. The product is packaged immediately after this final drying.

The material received on Nov. 2, 1942, was hermetically sealed in air in 5-gal. square cans. An analysis of samples of product from each of the several cans received indicated the moisture content of the product in each to be identical. The experimental pack was completed in the Continental Can Co. laboratories on November 20.

Because of an unavoidable delay, the packages were not placed at their respective storage temperatures until December 4. The oxygen contents of the CO_2- and nitrogen-packed cans, as well as the flavor of the product, were determined at the time the pack was made and also at the time the packages were placed in storage. There was no appreciable change in these factors during this time.

The following modifications of the standard examination methods were found necessary in the course of this experiment:

1. Color: Munsell disks required to adequately match the color of the dehydrated apple nuggets were not available until the two-month examination was made. Consequently, the data on color are not complete for the first two months of the storage period.

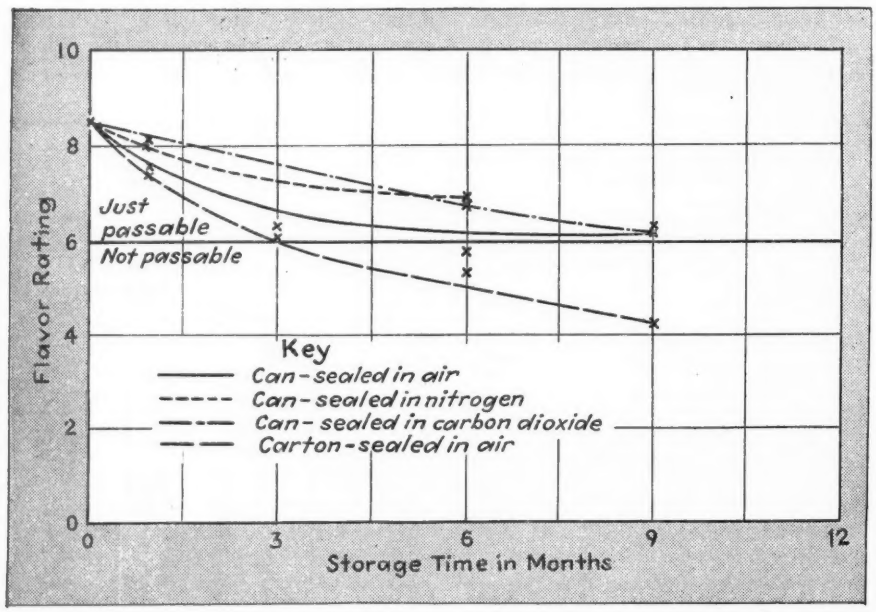


FIG. 2. Effect of storage time and packaging on rating of dehydrated apple nuggets stored at 98 deg. F.

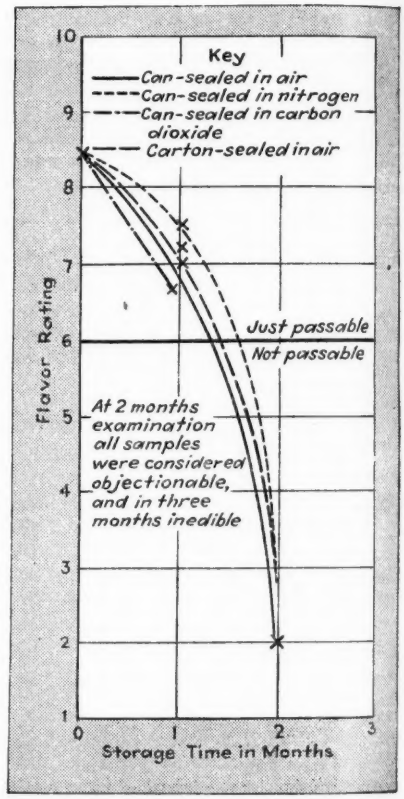


FIG. 3. Effect of storage time and packaging on flavor rating of dehydrated apple nuggets stored at 130 deg. F.

2. Reconstitution: All the flavor tests were made with apple sauce prepared from the samples according to the following formula:

40 grams of apple nuggets
24 grams of sugar
280 c.c. of water

The apple nuggets and water were simmered for 15 minutes, then the sugar was added and the mixture simmered for an additional 5 to 7 minutes.

3. Examinations of the apple nuggets after three months' storage at 130 deg. F. were discontinued because the product had become unpalatable. Also, there were insufficient samples to permit making an examination of product stored at 98 deg. F. for one year.

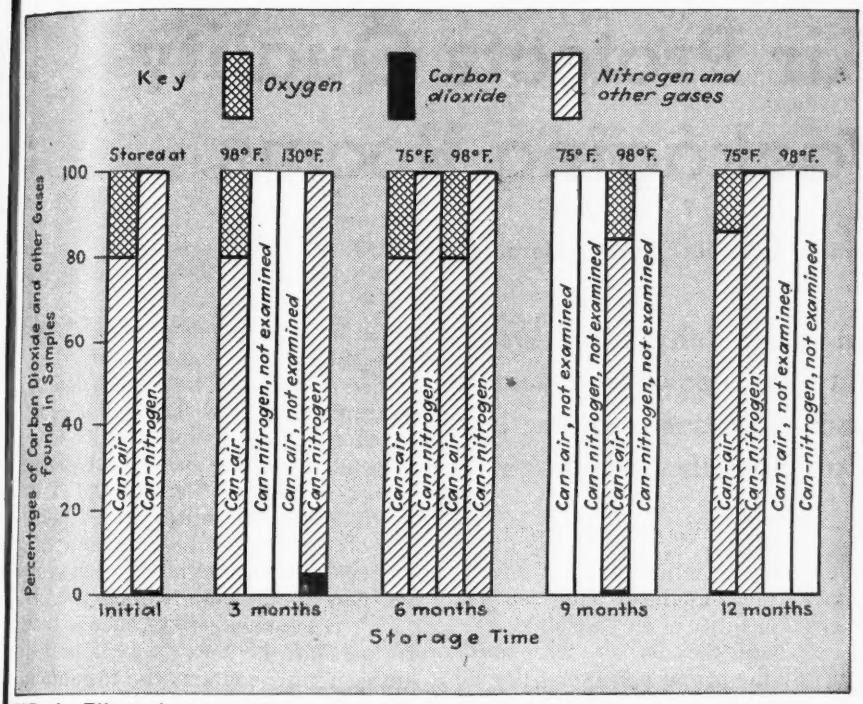


FIG. 4. Effect of storage time and temperature on evolution of carbon dioxide from dehydrated apple nuggets packed in air and in nitrogen.

4. The initial examination of the product was made at the time the packages were placed in storage, which was approximately three weeks after the packaging date. However, there was probably no significant change in quality, especially since the packages were being held at room temperature during that time.

Summary of Results

A. Effect of Packaging—In practically all of the examinations, the gas-packed product was preferred to that sealed in air when tested for flavor. Those samples not gas-packed were described as having a "slight off-flavor." A "straw" or "hay-like" odor was noticed in the product sealed in air, while gas-packed samples at the same examinations had a more typical apple odor. There was no appreciable difference between the nitrogen- and CO_2-packed samples.

As far as color, ascorbic acid, thiamine and riboflavin content are concerned, there was little difference between the samples packed in the various containers. It was felt that none of the vitamins for which analyses were made was present in sufficient quantities to warrant graphing of the results.

Appreciable moisture was picked up by the product packed in the cartons and stored at 98 deg. F. and 93 percent relative humidity. This absorption of moisture resulted in definite caking of the product. Apparently, it also resulted in slightly greater losses in quality as evidenced by the results of the later examinations.

B. Effect of Storage Time and Temperature—The data indicate that this product cannot stand prolonged storage at 130 deg. F. After two months of storage at this temperature, the product had darkened appreciably in color and had become unpalatable. Because of this deterioration, examination of the samples stored at 130 deg. F. were discontinued after three months. Storage at 98 deg. F. had far less effect on the product. After 6 months of storage at this temperature, the product in the gas-packed cans was still in fair condition, although its color had become somewhat darker. Storage at 75 to 80 deg. F. had little, if any, effect on the product, so that after 12 months in the gas-packed cans the product was only slightly inferior in flavor and color to the original samples.

The vitamin analyses showed the presence of very little thiamine and riboflavin and only a small amount of ascorbic acid. Very little change in their amounts was found in the course of the examinations.

A small amount of CO_2 was evolved by the product stored at 130 deg. F., but the amount of it found in cans stored at 98 deg. F. and at 75 to 80 deg. F. was negligible even at the later examinations.

Discussion of Results

1. There was surprisingly little evolution of CO_2 from this product at elevated temperatures in spite of the high sugar content. Also, this product showed greater general stability at elevated temperatures than most of the other products tested. This greater stability may be at least partially due to the very low moisture content.

2. The vitamin content of apples as reported in the literature is not particularly high. Consequently, it was no surprise to find that the dehydrated product had a low vitamin content. Furthermore, this product is treated with SO_2 during preparation. This should help to preserve the small amount of ascorbic acid present, but at the same time, it would tend to decrease the thiamine content.

3. The riboflavin values appear to increase slightly on storage. This is probably due to the production, in some cases, of compounds which also stimulate the growth of the organism used to measure the riboflavin microbiologically.

TABLE IV—Apple Nuggets (Crisps).

Results of periodic weighings of product packed in cartons and stored at 98 deg. F. and 93 percent relative humidity.

Storage time	Number of samples weighed	Average percent increase in product weight over original*
Initial	18	....
1 month	16	0.0
3 months	13	0.71
6 months	12	1.86
9 months	10	2.31
12 months	7	2.50

*These figures are corrected for the weight of water absorbed by the paper in the container (4 percent increase in container weight in 5 days).

TABLE V—Apple Nuggets (Crisps).

Results of periodic moisture determinations on product

Storage time	Storage temperature (deg. F.)	Package	Moisture content (percent of total weight)	Caking or lumping
Initial	.....	.....	0.8	None
1 month	98*	Carton	1.2	.....
3 months	98*	Carton	1.4	.....
6 months	98	Can—air	1.3	Very slight
	98	Can—N_2	0.8	None
	98*	Carton	3.5	Definite
6 months	75–80	Can—air	0.8	None
	75–80	Can—N_2	0.8	None
	75–80	Carton	1.0	None
9 months	98	Can—air	0.8	None
	98	Can—N_2	1.1	None
	98*	Carton	3.5	Definite
9 months	75–80	Can—air	1.1	None
	75–80	Can—N_2	1.1	None
	75–80	Carton	1.4	None
12 months	98*	Carton	4.8	Definite
12 months	75–80	Can—air	0.8	None
	75–80	Can—N_2	1.0	None
	75–80	Carton	1.1	None

*The paper packages stored at 98 deg. F. were also subjected to a relative humidity of 93 percent.

Controlled Air Protects Quality In Food Packaging Rooms

By A. A. GIANNINI, Application Engineer, Carrier Corp., New York, N. Y.

Hygroscopic foods, like bouillon cubes, dehydrated foods, macaroni products, hard candy and powdered lemon juice, coffee, malt extract and molasses require low humidity in packaging. This article tells how to get it

FOOD processors have long recognized the advantages of careful control over the quality of all ingredients entering into the final product. In line with this practice is the growing realization that the atmosphere must also be carefully controlled, because it is the medium that surrounds practically all processes—the product being manufactured is literally bathed continually in air. This not only indicates the importance of control of air purity but also of temperature and humidity, because these factors can often have an important bearing on quality and rate of production. This is especially true in the packaging and handling of hygroscopic food products.

There are many familiar examples of packaging difficulties because of adverse atmospheric conditions. For example, in the wrapping and compressing of bouillon cubes, high humidity will not only cause sticking of the wrapping machines with consequent shutdown, but in addition the product is likely to be spoiled. The effect of humidity on the moisture content of powdered coffee is also well known, and the need of controlled low humidity during packaging is evident. Because there are so many food products whose moisture content is affected by atmospheric humidity during packaging and related processes, it will be well to consider the fundamental nature of the relationship between moisture content of food and prevailing air conditions.

Moisture in Air

The atmosphere is a mixture of "dry air" and water vapor (steam). Both air and water vapor follow the laws of a perfect gas and also Dalton's Law, which states that the total pressure of air (viz., the atmosphere) is the sum of the partial pressures of the dry air and the water vapor, and the value of the partial pressures is dependent upon the relative quantities of air and water vapor. The amount of water vapor in a given quantity of air is small as compared with the dry air, and consequently the partial pressure of the water vapor, known as vapor pressure, is relatively low. At sea level, the total pressure of the air is only 14.7 lb. per square inch; and, since the partial pressure of the water vapor is but a small fraction of this value, the moisture in air can be considered as steam at very low pressures in the order of 0.10 to 0.50 lb. per square inch, and its properties can be found from standard steam tables.

As noted, vapor pressure varies with moisture content of the air. Moisture content is known as absolute humidity and is usually measured in grains per pound of dry air. Absolute humidity should not be confused with relative humidity, which, as the term implies, is a relative quantity and can be defined as the ratio of the actual amount of water vapor in a given quantity of air to the quantity of water vapor in saturated air at the same temperature.

The psychrometric chart, Fig. 1, shows the relationship between absolute humidity, relative humidity and temperature. In addition, the chart shows the relationship of these three properties to wet-bulb temperature. This latter item is the temperature recorded by a thermometer whose bulb is enclosed in a wetted wick and then whirled in the air. The evaporation of moisture from the wick causes a cooling effect, which in turn results in a temperature reading below that of an ordinary or dry-bulb thermometer. The dryer the air, the greater the evaporation of water from the wick and the greater will be the difference between wet-bulb and dry-bulb temperature. If the air is saturated, which means that the moisture in it exists as saturated steam, it then contains the maximum moisture it can contain at a given temperature. Under this condition, there will be no evaporation from the wetted wick and dry-bulb temperature will equal wet-bulb temperature. The combination of a wet-bulb thermometer and an ordinary thermometer is known as a psychrometer. Used in connection with the psychrometric chart, this is a convenient tool for measuring all the properties of air. For example, if the dry-bulb temperature is measured as 80 deg. F. and the wet-bulb as 70 deg. F., find on the chart the point of intersection of the vertical 80 deg. F. dry-bulb line and the oblique 70 deg. F wet-bulb line. We see that this point falls on the 61 percent relative humidity line, and by reading horizontally to the right the absolute humidity can be read as 94 grains per pound.

The relationship between vapor pressure and absolute humidity is shown in Table I.

If a mixture of air and water vapor is cooled to a point where the temperature corresponds to the temperature of saturated steam at the pressure (i.e., vapor pressure) of the moisture in the air, then condensation of the water vapor will take place. This temperature of condensation is known as the dew point. The dew point temperature of air at any condition can be found by reading horizontally to the left on the psychrometric chart to the curve of 100 percent relative humidity. Using the previous example, if we read horizontally to the left from the intersection of the 80 deg. F. dry-bulb line with the 70 deg. F. wet-bulb line, we find that the dew point is 65½ deg. F. The relationship between dew point and partial pressure is also shown in Table I.

TABLE I—Relation Between Vapor Pressure and Absolute Humidity.

Vapor pressure, inches of mercury	Absolute humidity, grains/lb.	Dew point, temperature, deg. F.
0.1096	15.0	20
0.1353	19.0	25
0.1663	24.0	30
0.2035	29.8	35
0.2478	36.4	40
0.3004	44.1	45
0.3626	53.4	50
0.4359	64.3	55
0.5218	77.2	60
0.6222	92.4	65
0.7392	110.2	70
0.8750	131.1	75
1.032	155.5	80
1.213	184.0	85
1.422	217.1	90

Moisture in Food

Solid materials such as food contain water in two general forms. Water existing on the surface or held in the voids of the material is known as "free" or "unbound" moisture, and its vapor pressure will be equal to that of water at the same temperature. "Bound" or "hygroscopic" moisture, on the other hand, is intimately associated with the physical nature of the material, and its vapor pressure usually is less than that of free water at the same temperature. All dried foodstuffs are at least dehydrated down to the point where the moisture can be considered hygroscopic, and the exact amount of this moisture contained in a sample of food is dependent on the temperature and humidity of the surrounding air. If the vapor pressure of the moisture in the air is greater than the vapor pressure of the moisture within the pores of the material, then water will "flow" into the material until there is equilibrium between the two vapor pressures. In the same manner, moisture will leave the material if its vapor pressure is greater than that of the surrounding atmosphere. The exact moisture content at which the water vapor will be in equilibrium with air at a fixed temperature and humidity is a characteristic peculiar to each material, and it can be determined only by experiment.

Practically all materials are hygroscopic in the sense that they will have a fixed moisture content in equilibrium with an atmosphere containing a fixed amount of water vapor, but the term "hygroscopic" is usually reserved for those materials in which this characteristic is sufficiently marked to cause measurably rapid changes in moisture content as the condition of the atmosphere changes.

Regain Characteristics

The percentage of moisture relative to its dry weight which a material retains in equilibrium with a given condition of relative humidity and temperature, expressed as a series of data or as a curve, is loosely termed the "regain" of the material. This term is derived from the fact that a dried hygroscopic substance regains moisture from an atmosphere having a higher vapor pressure than that existing in the material. Hygroscopic materials vary widely from one another in their regain characteristics, and specimens of the same material frequently will vary. In the case of dehydrated vegetables, there is likely to be marked variation within one species as a result of differences in variety, maturity, source and other factors.

As mentioned, the hygroscopic properties or regain characteristics must be determined experimentally. One of two methods is usually employed. The sample may be placed in a standard glass desiccator containing sulphuric acid or some salt which fixes the vapor pressure or relative humidity in the atmosphere of the container, and after equilibrium is reached the sample is removed and weighed. This weight is then compared to the weight of the sample when completely dried in a vacuum oven. This method is subject to some criticism because the samples employed are small and errors in weight measurements are thus magnified. Moreover, the material is exposed to comparatively motionless air within the desiccator, which is not a true condition, and errors are likely to occur when the material is removed to the room atmosphere for the purpose of weighing. The other method employs fairly large samples placed on an accurate balance, which in turn is placed in an air conditioned cabinet in which various conditions of humidity and temperature can be maintained with great accuracy. The weight of the sample is observed at the various conditions and compared to the weight of the sample when bone dry. From such experiments, the regain characteristics of various materials have been determined, and it has been found that the rate of change of moisture content with temperature is small when the moisture is represented as a function of relative humidity rather than absolute humidity. For this reason, it has been customary to present the data in a form whereby moisture content (at some fixed temperature) is represented as a function of relative humidity, and this can be assumed to be substantially true at any temperature.)

Table II gives the regain of certain cereal foods, and Table III the regain of some typical dried fruits. Figure 2 gives similar data for dehydrated vegetables in the form of curves. The curves have a shape which is characteristic of all materials when moisture content is plotted against rela-

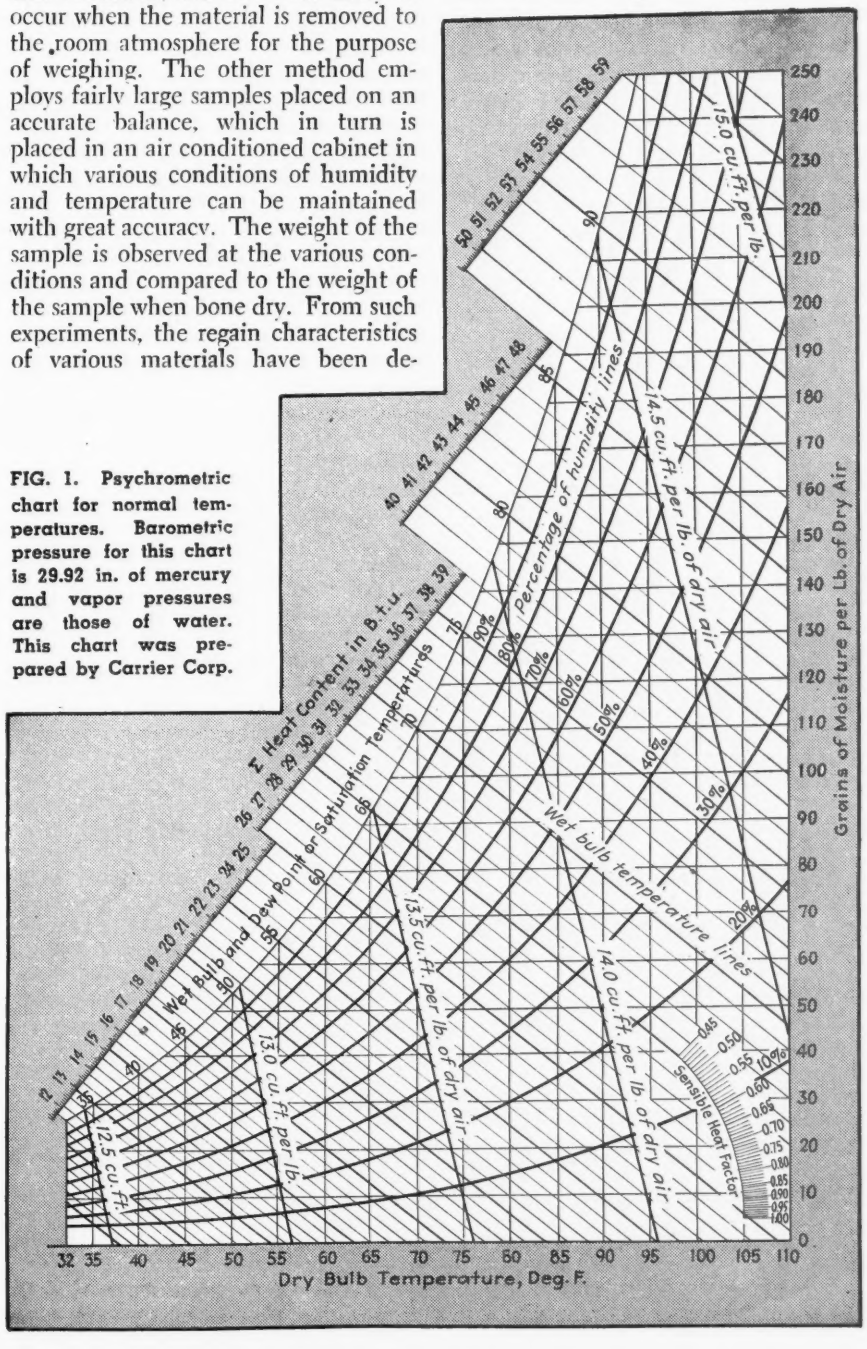

Grains of Moisture per Lb. of Dry Air
Dry Bulb Temperature, Deg. F.
Wet Bulb and Dew Point or Saturation Temperatures
Heat Content in B.t.u.
Percentage of humidity lines
Wet bulb temperature lines
Sensible Heat Factor
15.0 cu. ft. per lb.
14.5 cu. ft. per lb. of dry air
13.5 cu. ft. per lb. of dry air
14.0 cu. ft. per lb of dry air
13.0 cu. ft. per lb.
12.5 cu. ft.

FIG. 1. Psychrometric chart for normal temperatures. Barometric pressure for this chart is 29.92 in. of mercury and vapor pressures are those of water. This chart was prepared by Carrier Corp.

tively humidity, and incidentally they show the extent of the effect of change in temperature.

It is interesting to note that temperature has very little effect on the regain of carrots, whereas the effect on spinach is marked.

Moisture contents shown in Fig. 2 and Tables II and III are in percents on a dry weight basis. That is:

$$\text{Moisture content} = \frac{A - B}{B} \times 100$$

Where A = weight of sample at equilibrium.

B = weight of completely dehydrated sample.

Regain-characteristic data are important to the food processor where it is necessary to hold the finished product below a certain moisture content during packaging to prevent spoilage and production difficulties, or where the finished product must have a definite moisture content to meet specifications. For example, if dehydrated carrots must be packaged at not more than 5 percent moisture content, then from Fig. 2 it can be seen that to preclude the possibility of regain during packaging (and related processes such as inspection) the packaging room must be maintained at a relative humidity below 30 percent. Obviously, too, where products are sold on a weight basis and there are possibilities of an overdried product, it is desirable to know what air condition will permit regain to the maximum allowable moisture content.

Where the food processor does not have the regain data on his particular product, he has recourse to many independent laboratories equipped to obtain this information. However, if the problem is merely one where it is desirable to keep the humidity low enough to prevent production difficulties, the processor may determine "safe" conditions by keeping a log of atmospheric conditions (i.e., wet-bulb and dry-bulb temperatures) against production records. If such a log is kept over a reasonably long period of time, it will be possible to select some combination of temperature and relative humidity that will assure uninterrupted production. The conditions selected must be tempered somewhat by economic considerations, because the cost of air conditioning apparatus increases as the temperatures and the humidity which are to be maintained are lowered.

TABLE II—Hygroscopic Regain of Cereal Foods.

The normal moisture content expressed in percent of dry weight at various conditions of relative humidity. All observations taken at approximately 75 deg. F.

Percent relative humidity	Macaroni	Flour (patent)	Bread	Crackers
5	3.50	1.75	.60	1.00
10	5.00	2.20	1.00	1.60
15	6.20	3.25	1.40	2.00
20	7.10	3.90	2.00	2.55
25	8.05	4.50	2.50	3.10
30	8.75	5.05	3.10	3.50
35	9.60	6.50	3.85	3.80
40	10.60	6.90	4.60	4.00
45	11.75	7.50	5.80	4.50
50	12.20	8.50	6.50	5.05
55	13.00	9.00	7.45	6.50
60	13.75	10.08	8.50	6.90
65	15.00	11.50	9.85	7.60
70	16.60	12.60	11.40	8.70
75	17.45	13.80	12.50	9.85
80	18.75	15.80	13.90	11.10
85	20.06	17.50	16.75	12.00
90	22.40	19.00	18.90	13.10

Source — Bailey, *Journal Industrial and Engineering Chemistry*, Vol. XII, No. 11, Nov. 1920. Wilson, *Publication of the Massachusetts Institute of Technology*, Serial No. 52. Carrier Engineering Corp. Research Laboratories.

TABLE III—Hygroscopic Regain of Dried Fruits.

Normal moisture contents at various conditions of relative humidity. Observations taken at approximately 70 deg. F.

Relative humidity, percent	Peaches	Prunes	Apricots	Raisins
25	....	..	7	8
35	5	11	8	10
45	6.5	12	9.5	12.5
55	10	15	13	17
65	16.5	19	18	22
75	22.5	25	24	27.5
85	33	..	....	....

Data taken from "Improvement Needed in Technic for Testing Food Packages," by T. A. Schwarz, *Food Industries*, Vol. 15, September, 1943, p. 69.

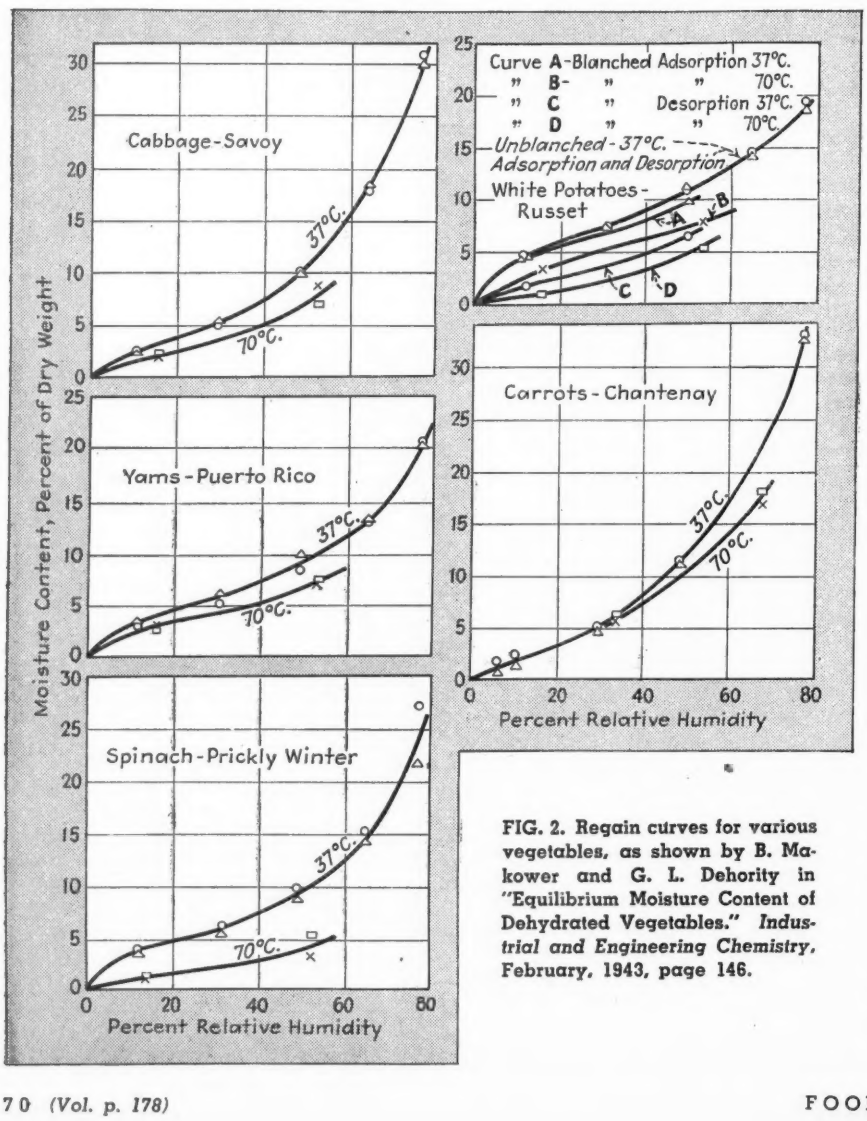


FIG. 2. Regain curves for various vegetables, as shown by B. Makower and G. L. Dehority in "Equilibrium Moisture Content of Dehydrated Vegetables." *Industrial and Engineering Chemistry*, February, 1943, page 146.

Air Conditioning Systems

There are many different "systems" of air conditioning which can provide atmospheres of definite characteristics within enclosures, but they can usually be classified into two major groups as follows:

1. Those in which moisture is removed from air by cooling below the dewpoint (usually by refrigeration) so that moisture and temperature reduction takes place simultaneously.

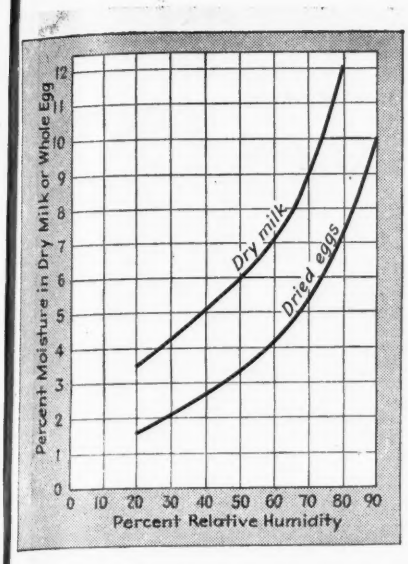

Percent Moisture in Dry Milk or Whole Egg
Percent Relative Humidity
Dry milk
Dried eggs
0 10 20 30 40 50 60 70 80 90
0 1 2 3 4 5 6 7 8 9 10 11 12

FIG. 3. Regain curves for dry milk and dried whole eggs, from "Drying and Dehydration of Foods," by H. W. von Loesecke, Reinhold Publishing Corp., New York, 1943, page 250.

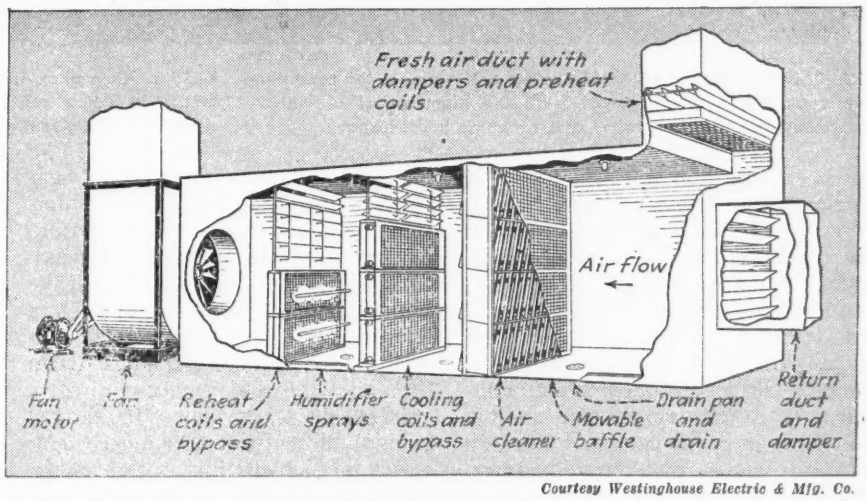
2. Those in which moisture is removed from air by desiccating equipment, independently of temperature reduction.

The great majority of air conditioning systems fall into the first category, and apparatus of this nature has been highly developed. Figure 4 shows the items of equipment comprising a typical central-station plant. From this diagram it will be noted that a mixture of outside air and recirculated air is drawn through the apparatus and delivered to the conditioned space by a fan. The exact quantity of outside air employed on a particular job is dependent on the ventilation requirements of the enclosure and will be affected by such factors as number of people and the presence or absence of fumes. The air mixture passes successively through: (1) air cleaning apparatus; (2) cooling and de-humidifying coils; (3) steam reheat coils.

Many different types of air filtering apparatus may be employed, depending on the degree of cleanliness required. Figure 4 shows the electrical-precipitation type of equipment, in which the particles of dust, powder and other impurities pass through an electrostatic field where they are given an electrical charge and are then collected on plates which are charged with 5,000 volts, alternately positive and negative. This type of filter is capable of removing 90 percent of the air-borne particles as small as 1/250,000 in., and is the most effective air filtering means commercially available. Fig. 5 shows a typical renewable-type filter which removes dirt from air by impingement on a fibrous filtering medium consisting essentially of gauzy cellulose tissues held together loosely by embossing. The filtering medium is stretched over a special metal frame, and can be easily discarded and replaced when dirty. There are many variations of this type of filter.

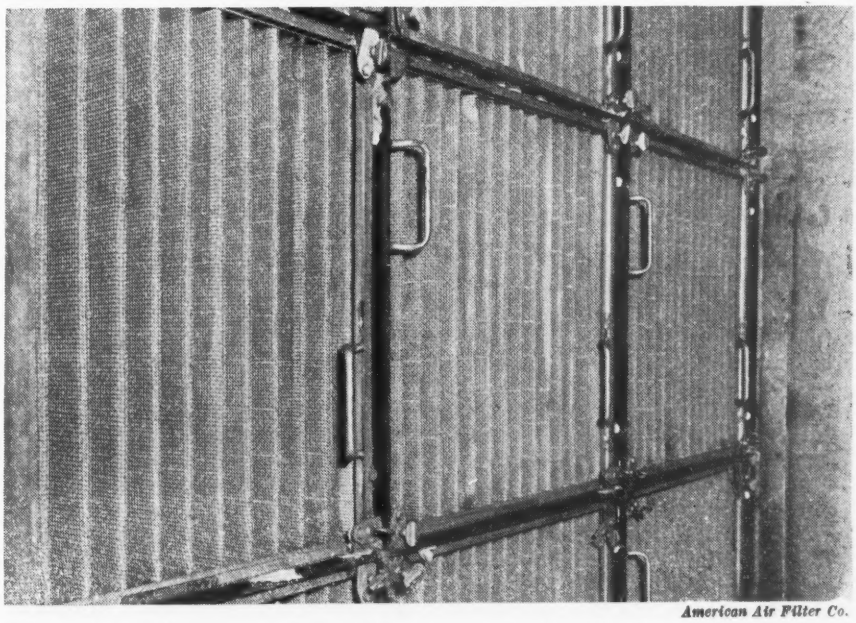
By maintaining the average surface temperature of the cooling coils at a point below the dewpoint temperature of the entering air, moisture will be condensed out of the air at the same time that it is cooled. The coils are kept cool either by the circulation within them of chilled water or by the direct expansion of a refrigerant. It is also possible to employ a "washer," in which a spray of chilled water is substituted for the cooling coils, thus affording the necessary contacting surface. The air is cooled and dehumidified to a condition below the temperature and absolute humidity to be maintained in the room, so that upon entering the conditioned space it will be capable of absorbing heat and moisture generated within or leaking into the space. Characteristically, the relative amounts of moisture and heat absorbed are fixed by the surface temperature of the cooling apparatus. However, the relative heat and moisture "loads" of a conditioned space vary considerably from day to day and from hour to hour, and as a result it is often possible (in an attempt to lower the humidity) to cool the space to a temperature below the desired point. In such instances it becomes necessary to reheat the air, and reheat coils are included in the system. The reheat coils also provide heating of the conditioned space in winter.

Figure 6 shows a "self-contained" air conditioning unit which includes cooling and heating coils, filters, fans



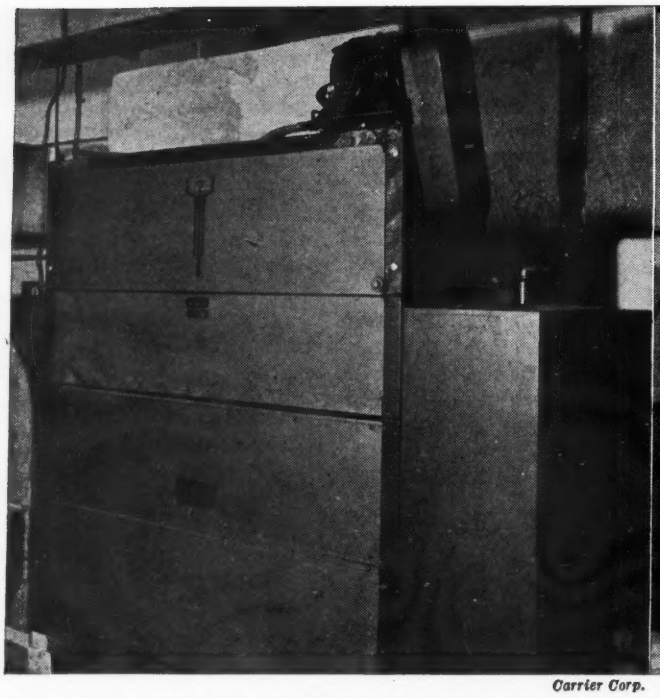
Courtesy Westinghouse Electric & Mfg. Co.

FIG. 4. Diagram of a typical central-station air conditioning plant of a type suitable for use in connection with packaging operations.



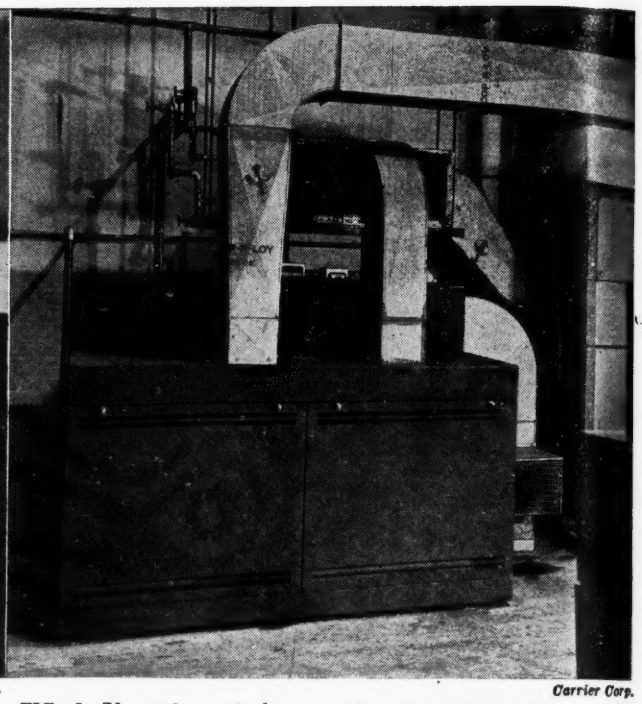
American Air Filter Co.

FIG. 5. Renewable type air filter which removes dirt from the air by passing the air through a replaceable filtering material.



Carrier Corp.

FIG. 6. Self-contained air conditioning unit suitable for conditioning a packaging room contains all the elements of a central-station system, but is smaller and occupies limited space.



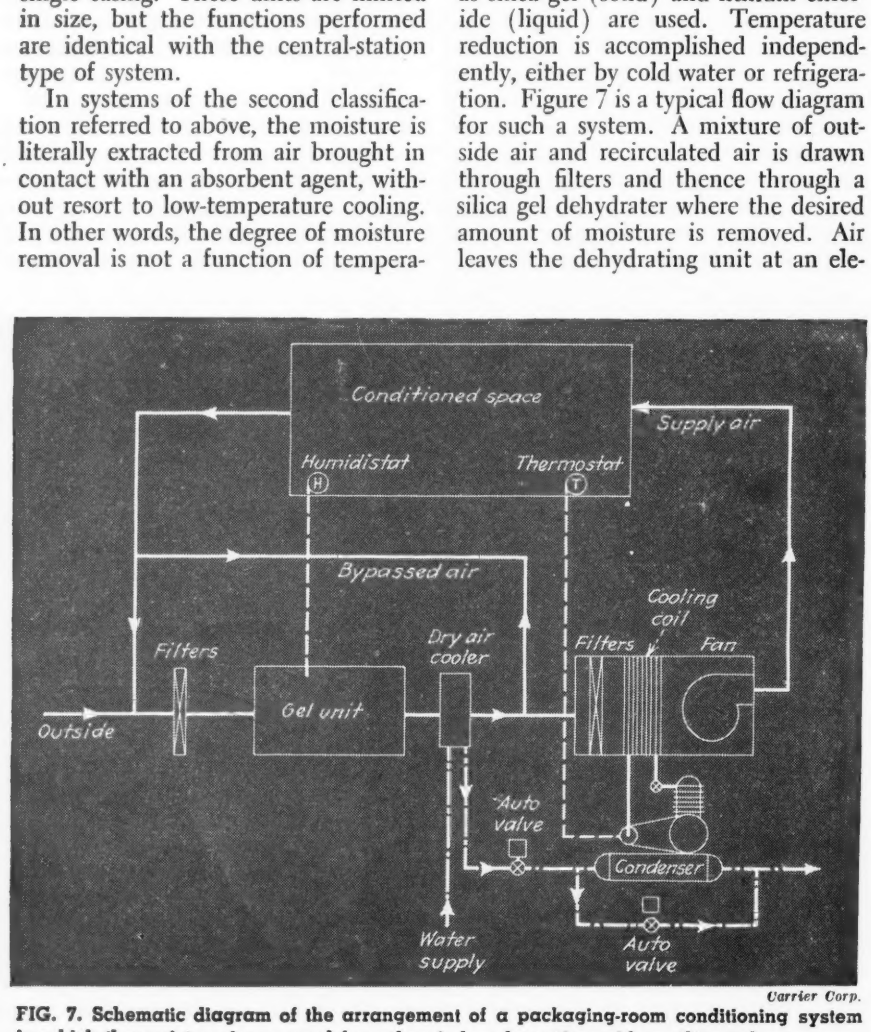
Carrier Corp.

FIG. 8. Absorption unit for removing the moisture from air by means of silica gel. Such units are suitable for dehumidifying the air in food packaging rooms.

and a refrigeration unit, all within a single casing. These units are limited in size, but the functions performed are identical with the central-station type of system.

In systems of the second classification referred to above, the moisture is literally extracted from air brought in contact with an absorbent agent, without resort to low-temperature cooling. In other words, the degree of moisture removal is not a function of temperature reduction. Absorbent agents such as silica gel (solid) and lithium chloride (liquid) are used. Temperature reduction is accomplished independently, either by cold water or refrigeration. Figure 7 is a typical flow diagram for such a system. A mixture of outside air and recirculated air is drawn through filters and thence through a silica gel dehydrater where the desired amount of moisture is removed. Air leaves the dehydrating unit at an elevated temperature (because of release of latent heat by the moisture condensed within the pores of the absorbent) and its temperature is reduced to the desired point in two stages—first by tap water in a coil and then by a direct-expansion refrigerated coil. Where cold (58 deg. F. or below) well water is available, the necessary temperature reduction can often be economically accomplished in one step by employing this water in a suitable cooling coil. The main feature of systems of this nature is the independent control of temperature and humidity afforded without the use of reheat.

Automatically regenerated dehydrating apparatus using either solid or liquid absorbent agents is commercially available. Figure 8 shows a typical unit using a solid desiccant.



Carrier Corp.

FIG. 7. Schematic diagram of the arrangement of a packaging-room conditioning system in which the moisture is removed from the air by absorption with a silica gel.

Choice of Systems

The choice of the most suitable system for a particular job when all factors are taken into consideration is not a simple matter. The maintained conditions as determined from the regain data have a great deal to do with this choice. Generally speaking, if the maintained dewpoint—or absolute humidity—is comparatively high (45 deg. F. or above) the refrigeration-plus-reheat method is preferred. On the other hand, this system has a limitation on the dewpoint temperature it can maintain conveniently, because its effectiveness depends upon contacting the air with a cold surface. Obviously, if the surface temperature approximates 32

(*Turn to page* 135)

THE FOOD COMES FIRST In Package Design

Packages designed from the inside out provide maximum protection at minimum cost. Specifications should be based on systematic study of physical and chemical characteristics of the food

By GRACE HIGHTOWER, Assistant Editor, "Food Industries."

PROTECTIVE packaging is a fundamental problem in food preservation. But it has only been within the last two or three years, when extensive package changes were made necessary by food distribution requirements and material shortages, that this fact has been generally recognized. Food technology has been extended to include all types of packaging for shipment and storage.

From the standpoint of the food industry, the problem of packaging in general can be divided into the phases of determining the amount and type of protection required for food, selecting a suitable material and design of package to meet those requirements, and finally, providing for the actual mechanical operations of filling, sealing, labeling and packing.

As a matter of fact, food packaging developed in the reverse order. Automatic machinery was built to handle cans and cartons. Then there was a period when attention largely centered on the package, particularly as new materials became available. Now the emphasis is shifting to the keeping characteristics of the foods themselves.

It is only by having at hand the data on protection required by each of his products that the food manufacturer will be ready to make a choice among the multitude of good packaging materials offered when emergency restrictions are removed. And it is only by understanding the nature of the protection required that he will be able to make the most effective use of packaging materials now available.

The intensive research which has been centered on questions involved in packaging for the emergency—for foods going to the armed forces and Lend-Lease—has uncovered and solved many problems, but much of the information developed with a view to extreme conditions is not directly applicable to packaging for domestic distribution under normal conditions.

For this reason, it is suggested that any manufacturer not now maintaining an active package research project should make a comprehensive survey of the protection required by his products under the conditions expected for civilian markets now and after the war.

General Product Study

Much of the information about the properties of the food that affect package design will already be available, but a comprehensive survey will show where further investigation should be directed. This discussion applies chiefly to consumer and institutional packs, but the method outlined is widely applicable.

Heat-sterilized foods are not considered, because the "package" for this type is an integral part of the processing operation, and the requirements must be understood before processing can be undertaken. So far they have been met only by the tin can and the glass jar with a resilient gasket and a glass or metal top.

In undertaking a packaging study of this sort, it is well at the outset to distinguish between those foods that must be packaged and those that are packaged for convenience but which have no technical, as opposed to commercial, need for package protection. In other words, just what will happen if the product is not packaged? Will it spoil or lose flavor or become unsaleable or inedible?

If not, the problem is one of purely commercial significance and must be tied in rigidly with price and market considerations.

Where protection is necessary, those properties should first be considered which determine the general form of the package that will be required. These can most easily be indicated by a series of questions:

1. Is the product subject to mechanical damage, as by breaking or distortion?
2. Can the product as a whole be lost, as by spilling, leaking or sifting?
3. Are there constituents or phases that may be lost through volatilization, grease leakage, loss of moisture, aroma or solvent?
4. Is the product subject to deterioration through picking up moisture or foreign flavors, or by oxidation? Is it affected by exposure to light? Is it subject to bacterial contamination, mold or insect infestation?

Interactions between the food and the packaging material may preclude the use of packaging materials which otherwise appear suitable. The product may be abrasive in the sense that it scuffs or rubs the package liners. If it contains fat or oil, or an oil-bearing ingredient, greaseproofness is needed in the packaging material. Chemical constituents other than fats and oils, such as solvents, acids and alkalies, may affect some materials. On the other hand, the product may be deleteriously affected by certain metals, papers with some types of fillers or coating materials, and possibly by some adhesives normally used in packaging.

Data Required

This means that the food technologist will have to be prepared to furnish definite information on the mechanical characteristics of the product which influence package design, certain chemical and physical characteristics that are capable of quantitative expression, and factors which are important because of the fact that the material is a foodstuff, but which at present can be evaluated only qualitatively.

There are at present no recognized standard methods for evaluating any of these. Abrasiveness and stickiness determine the nature of the surface in contact with the foodstuff. The tendency to breakage will determine the degree of mechanical support or cushioning protection which must be incorporated in the package. For solid

particles, powders and crystals, it is sometimes necessary to use extreme care in the selection of materials and design of the package because of a tendency to sift through ordinary seals. This can be correlated with the particle size. For both solids and liquids, the flow characteristics must be considered in the package design from the standpoint of getting the material into and out of the package.

Where quantitative data can be obtained it can be incorporated directly into package specifications. The moisture equilibrium will indicate whether protection must be given against the passage of moisture vapor into or out of the package, and how effective this protection must be for the food.

Definite information on the grease and oil, type, amount, flow point and whether it is emulsified or free is essential in selecting a material. Greaseproof papers, for instance, should be accepted only if the greaseproofness has been tested with the fat or oil with which it is to be used.

Equipment for determination of moisture equilibrium, oxidation stability and light sensitivity may not be available in the ordinary plant laboratory. However, if the product is particularly sensitive, the equipment is probably essential for proper manufacturing control. If it is not particularly sensitive, data of sufficient accuracy can be obtained with the means at hand. Moisture equilibrium can be determined with sufficient accuracy in many cases by holding samples of the product over constant humidity solutions, shielded from temperature fluctuations. The development of rancidity, flavor change or other deteriorations can be explored by simple exposure tests, depending on taste and smell. The point is that the technologist should find out which of these factors must be considered in the packaging specifications, and the extent to which they are important.

The factors peculiar to foodstuffs which must be evaluated in specifying packaging protection include:

Rate of flavor loss
Reactions involved in flavor loss
Tendency to pick up foreign odors
Rate of vitamin loss
Texture changes due to moisture
Liability to bacterial infection
Liability to mold growth
Liability to insect infestation

With this information at hand, the food technologist is ready to write his specification for packaging protection. He will be able to state that the package must provide certain mechanical features to hold the product until it is used, that it must prevent

(*Turn to page 138*)

Basic Food Package Specifications as Determined by the Protection Required.

Typical products	Basic specifications for the package	Special requirements due to the characteristics of the product
	Liquids	
Beer Carbonated beverages Still beverages Flavoring extracts Vinegar Cider Sirups—maple, honey, corn, invert Molasses Oils French dressing Liquid sauces Milk	Rigid, leakproof, provided with some sort of pouring means Reasonably tight reclosing when all of product is not used at once Sterile as produced or capable of being cleaned and sterilized	Beer and carbonated beverages must be sealed against pressure Flavoring extracts lose highly volatile essential oils and solvents, also are damaged by light. Packaging material must be unaffected by solvents and oils Oils have a tendency to "creep" and need a special type of sealing Milk must avoid metallic contamination, foreign flavors and bacterial contamination
	Liquids plus solids	
Sauerkraut Pickles Relishes Horseradish Brine preserved vegetables Olives Catchup Maraschino cherries Fruit in heavy sirup	Rigid, leakproof, must support weight of contents	Sauerkraut, pickles, relishes and horseradish require a container that is not affected by acetic or lactic acid Brine preserved vegetables must be packed in material unaffected by strong acid brine Olives and catchup must be protected against bacterial infection (hermetically sealed)
	Semi-solid (plastic)	
Solid shortenings Oleomargarine Butter Cheese spreads Process cheeses Nut butters Salad dressing Sandwich spread Mayonnaise Prepared mustard Jams, jellies and preserves Chocolate sauce Marshmallow cream Mincemeat	Sufficient strength to hold the product when handled	For the first ten on this list, package must be greaseproof Butter must be protected against foreign flavors and bacterial contamination Nut butters require a package that will not leak if oil separation occurs Salad dressing, sandwich spread, mayonnaise and prepared mustard contain acetic acid Jams, jellies and preserves must be protected against mold with moisture vapor proof seal Sugar-preserved products, chocolate sauce and marshmallow cream must have lining or inner surface to which they will not stick
	Solids—large units	
Bread Rolls Pies Cakes Fruitcakes Candy bars Bouillon cubes Yeast	Require little or no mechanical support but must be protected against distortion Must prevent gain or loss of moisture	Pies and cakes require mechanical support, package must have inner surface to which they will not stick Bouillon cubes require protection from moisture Yeast needs greaseproof wrapping, to prevent staining of the package
	Solids—multiple units, not free flowing	
Doughnuts Crackers Cookies Potato chips Pretzels Candy Glacé fruit Coconut shreds Dried fruits	Must have mechanical support	Doughnuts and potato chips require greaseproof packaging Potato chips, crackers, cookies require protection against breaking, and against moisture gain Candy and glace fruits must be protected against mechanical damage, sticking, and moisture gain
Macaroni or beans, dry with sauce		Sauce requires protection against moisture, also presents grease and flavor problems
	Solids—free flowing	
Prepared breakfast foods Coffee Bread crumbs Wheat germ Whole spices Tea	Container must be rigid or firm enough for easy handling in shipping and selling	Prepared cereals must be protected against moisture which causes changes in texture Coffee as roasted beans requires only greaseproof container with some moisture protection; ground roasted coffee must be protected against moisture vapor, flavor loss, oxidation, grease staining of package
Flours Starches Sugar Salt Mixes—waffle, pancake, biscuit, cake Mixes—gingerbread, spice cake Cocoa Ground spices Baking powder Dessert powders Milk powders Malted milk Coffee powders Beverage powders	Package rigid enough to hold shape in shipping and handling Closure or seal designed to prevent sifting Must hold remaining portion of contents when not all used at once	Sugar and salt must be protected against moisture Mixes must be protected against oxidation, moisture gain (particularly because of loss of leavening power). Have some tendency to pick up foreign flavors Gingerbread and spice cake mixes must also be protected against flavor loss, and present a much more acute moisture vapor problem Ground spices must be protected against oxidation, breathing of the package which will cause flavor loss, grease staining of package Dessert powders, milk powders, malted milk, coffee powders and beverage powders, being made for easy solution, must be protected against moisture gain and also packaged so that if they do become moist the package will not leak. Must have lining to which they will not stick
Dehydrated eggs Dehydrated vegetables Dehydrated soups Dehydrated fruits	Protection against moisture vapor, oxidation, flavor transmission	Protection required varies with individual product, has been more thoroughly investigated and reported than any of the other groups
	Frozen foods	
Sharp frozen fruit Quick frozen meat, fruits and vegetables Frozen eggs	Moisture tight barrier, high wet strength Mechanical strength to hold product when thawed	

Cabinet Dehydraters Suited To Small-Scale Operations[1]

By E. A. BEAVENS,* Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, U. S. Department of Agriculture.

PART III—Single cabinets are practicable for experimental work. Multistage cabinet units, combination compartment-and-tunnel systems and duplex cabinet arrangements are used for commercial operations

SINGLE cabinet dehydraters are particularly useful in commercial plants for obtaining experimental dehydration data that can be applied to large-scale tunnel operations. The small cabinet illustrated in Fig. 5 (see Part I, January, 1943) would be useful for this purpose, with trays of the same size, construction features and stacking arrangements as actually used in a tunnel. The trays are loaded to the same capacity as in commercial practice, and the same air velocity blown through the trays as in the tunnel. A constant wet-bulb temperature of approximately 90 deg. F. is maintained throughout the dehydration period, and the dry-bulb temperature increased rather than decreased as in a normal cabinet operation. This is done because in the case of commercial counter-flow tunnels the products enter the cool end at a temperature of 115 to 125 deg. F., and this temperature rises as the product progresses toward the hot end, which is usually kept at 150 to 165 deg. F. The trays are removed and weighed at definite time intervals to obtain drying curves and observations on the product. With this procedure, actual drying conditions that occur in a counterflow tunnel dehydrater can be simulated on a small scale in a cabinet dehydrater. Valuable dehydration data can be obtained in a similar manner on parallel-flow and center-exhaust tunnels by adjusting the temperature to correspond to those used in actual practice. Considerable time and cost on large-scale operations can be saved by pilot-plant runs in a cabinet dehydrater.

Multistage Cabinet Dehydraters

Several continuous systems have been developed for commercial and semicommercial operations with cabinet dryers having capacities of 5 to 25 tons of fresh material per 24 hours, and even higher in some cases. The Phoenix Indian School, at Phoenix, Ariz., has developed a multistage dehydrater consisting of two cabinet dryers and an equalizing bin. The first stage, or predryer cabinet, is of the type illustrated in Fig. 3 (Part I). This cabinet holds 500 to 800 lb. of material (depending on whether the product is a leafy or a root vegetable) on two stacks of 3x3-ft. slanting trays. High initial drying temperatures, high wet-bulb depressions, and a high air velocity are used in this section to give a high initial drying rate. After an approximate drying period of 2 hours at temperatures of 200 deg. F. or more, down to 175 deg. F. for most products, the trays are removed from this section and placed in a second-stage cabinet dryer of the type illustrated in Fig. 6. Drying is continued in this section for an additional 1½ to 2 hours at finishing temperatures of 130 to 165 deg. F., or until the moisture content of the product is lowered to 10 percent or less. The final drying to 7 percent or less moisture is carried out in an equalizing bin at temperatures of 120 to 125 deg. F. Continuous operation is obtained with these units by predrying two stacks of trays in the first section, moving them into the secondary section, and repeating to fill this latter cabinet with four stacks of trays. When the third set of trays comes from the predryer, the first set is removed from the secondary dryer, the second set moved over into its place, and the third set moved into the vacant space. The contents of the trays coming out of the secondary dryer are scraped off into the equalizing bin to complete the drying. This procedure is repeated at scheduled time intervals so that each set of trays is dehydrated under similar conditions.

Combination Compartment-and-tunnel Systems

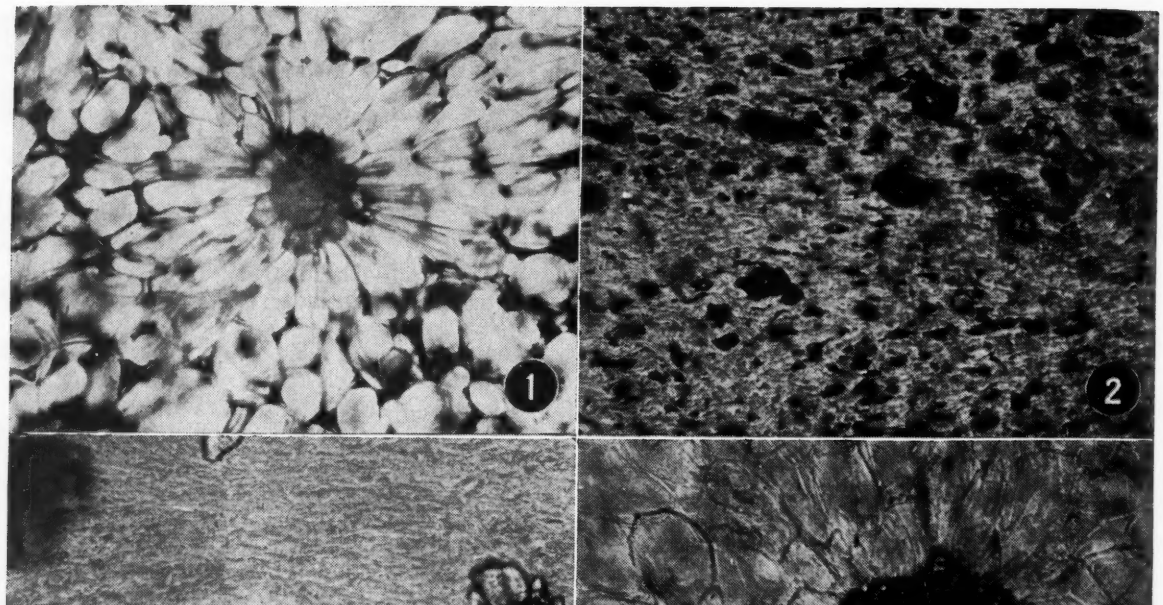
A cabinet dehydrater of the type illustrated in Fig. 3 but equipped with a 9-ft. multivane propeller-type fan is being used by a small commercial firm to handle their entire output. The cabinet holds six stacks of slanting 3x3-ft. wire-bottom trays piled 9 ft. high and arranged in a double row of three stacks each. An indirect-combustion gas heater is so arranged that three different temperature levels are maintained in the cabinet, ranging from approximately 210 deg. F. down to 175 deg. F., the hottest part being at the entrance end. Two sets of trays are shoved into the cabinet at intervals of 15 to 20 minutes, so that each set is exposed to the three temperature levels for the above-mentioned lengths of time, or a total of 45 to 60 minutes. Later, a finishing tunnel was added to the exit side of the cabinet to accommodate six or eight pairs of stacks, which are exposed to a constant finishing temperature for an additional 2 to 2½ hours. A heater-and-blower unit is installed in this tunnel, and the heated air is blown through the double stacks of trays in a zig-zag fashion by means of properly located vertical baffles. This is done so that the open side of the trays do not have to be turned from their through-circulation position into a counterflow position. After removal from the finishing tunnel, products are completely dried in an equalizing bin.

A more elaborate commercial dehydration system consists of a series of several through-circulation cabinets of the type shown in Fig. 3 but with the heater system built in the bottom instead of the top. These sections are built together as a single unit, each

(Turn to page 135)

[1] Bureau Publication, No. O.P. 4061.

* Laboratory of Fruit and Vegetable Chemistry, 148 South Mission Road, Los Angeles 33, Calif. Further information on designs of dehydraters discussed here can be obtained from this laboratory or from the Western Regional Laboratory, Albany 6, Calif.



Photomicrographs (X84) showing structure of fresh, dehydrated and refreshed pear fruit. FIG. 1. Flesh of fresh pear fruit showing stone cell group, thin-walled parenchyma cells and air-filled intercellular spaces. FIG. 2. Flesh of dehydrated unblanched pear fruit. The cells have collapsed, entrapping many air bubbles. FIG. 3. Flesh of dehydrated blanched pear fruit. All intercellular air has been eliminated. FIG. 4. Flesh of blanched dehydrated pear after being refreshed. Cells have attained almost original size and form.

Some Effects of Blanching

Displacement of intercellular air is one of the most important changes produced by blanching. The effects are described and illustrated. Erroneous ideas about blanching are pointed out

By A. S. CRAFTS,
College of Agriculture,
University of California,
Davis, Calif.

BLANCHING is used in the preparation of many vegetables for dehydration. It is also being considered as a pretreatment in the dehydration of fruits. Many storage and cooking tests have proved the advantages of blanching, but to blanch vegetables and fruits properly for dehydration one should fully understand the various changes that take place.

Cruess and his associates have described the principal chemical changes brought about during blanching (Mrak, Phaff, Fisher and Mackinney, 1943); these are the inactivation of enzymes and a general softening of the tissues that promotes rapid refreshing and reduces toughness in the cooked product.

In addition to chemical changes, there are several physical changes that bring about improvement in the appearance of the dehydrated product and contribute to its keeping qualities. Probably the most important of these is the displacement of intercellular air.

Figure 1 shows a thin section of fresh pear tissue. In the center is a group of stone cells that make up the small, gritty particles characteristic of this fruit. Surrounding this are the thin-walled, ovoid and spherical parenchyma cells. Occupying the spaces between these is the intercellular air, shown as dark irregularly shaped areas in the photomicrograph. Under the microscope these air bubbles are dark because they disperse the light. To the naked eye they reflect light from the cut fruit surface and consequently give it a glistening white appearance. When the intercellular spaces are completely filled with liquid, the fruit assumes the dull, translucent appearance characteristic of the cooked or blanched product.

Displacement of Air

Three effects of blanching account for the displacement of intercellular air. First, the heat expands it and most

of it escapes from the cut surfaces through intercellular spaces. Second, heating kills the cells, renders them permeable and allows the sap to escape. Third, it softens the cell walls so that they bend and give under the compressional forces of surface tension.

As blanched tissue cools, the bubbles in the intercellular spaces contract. If the tissue has been near the temperature of boiling water long enough, practically all of the air has diffused away and water vapor has taken its place. This, upon cooling, condenses and the bubbles disappear completely. Small bubbles may remain if air displacement has not been completed. These tend to decrease in size and disappear under the influence of the surface tension of the liquid which compresses them and slowly forces the gases into solution.

Dehydrated Pear Tissue

Figure 2 shows a thin section of dehydrated, unblanched pear tissue. The intercellular air has been trapped between the cells and, though the mass of pear flesh has contracted appreciably, a fair proportion of the volume is still occupied by air. Figure 3 shows a similar section of dehydrated, blanched pear. Here the air has been completely displaced and the tissue is clear and translucent. The pear half from which Fig. 2 was prepared was opaque and when placed in water would float because of the buoyancy of the bubbles.

What Actually Happens

Observation of the process of dehydration of blanched and unblanched tissues under the microscope provides a complete picture of the processes taking place. During blanching the bubbles of intercellular air rapidly expand and push out along the spaces until they reach a cut surface. Upon cooling, the gases contract and the bubbles are replaced by sap that leaks from the killed cells. Then, as dehydration takes place, the whole tissue collapses, the walls folding and compressing as dehydration progresses. If blanching has not been thorough, bubbles may reform. And, if the walls are not sufficiently plastic, the bubbles will remain in the finished product, making it opaque.

When unblanched pear flesh is dehydrated, the air bubbles present in the intercellular spaces slowly increase in size as the drying proceeds. As it approaches completion the cells slowly die, sap is released, and the minute passages and small bubbles are displaced as a result of the compressional action of surface tension. The larger ones, however, persist, as is shown in Fig. 2. In some instances these bubbles may be so large that compressional forces are insufficient to force the gases into solution. In other cases the form of the bubbles indicates that they are supported in part by the cell walls that have not been rendered plastic enough to yield under the force of surface compression.

The above description concerns pear tissue. Similar studies have been conducted on apricot, peach, nectarine, apple, and prune; also on carrot, cabbage, sweet potato and white potato. Among the fruits, prune flesh has very little intercellular air, and experience has shown that blanching is not necessary to produce a satisfactory product. Blanching of prunes, however, does improve the texture and cooking qualities as well as reducing the rate of darkening of the flesh with time.

In the case of white potato tissue intercellular air is relatively small in volume and so its displacement has little effect upon the appearance of the finished product. With potato, gelation of the starch is the most prominent change taking place upon blanching, and this, along with the softening and splitting of the cell walls, makes the blanched product one of entirely different character than the unblanched.

Effects of Intercellular Air

Intercellular air in fruit and vegetable tissues determines to a large extent their appearance. In the dehydrated product it often contributes to a dirty-white, opaque appearance that is unattractive and, in the case of fruits, unfamiliar to the buying public.

Intercellular air acts as an insulator restricting the inward movement of heat and the outward diffusion of water during dehydration. Dehydration time may be reduced as much as 25 percent in some instances by blanching. (See Mrak, Phaff, Fisher, and Mackinney, 1943.)

Intercellular air trapped in the tissues contains gaseous oxygen that is free to react with ascorbic acid during storage. Blanched products usually keep better than unblanched.

Complete displacement of intercellular air during blanching and dehydration may be taken as an index of chemical and physical changes in the cell walls. These changes bring about marked improvement in texture of the cooked product.

Wrong Ideas About Blanching

Several erroneous ideas prevail with regard to the effects of blanching. One is that blanching "breaks down the cells." Figure 4 shows a thin slice of rehydrated tissue from the same piece of pear as Fig. 3. It is evident that the cellular structure has been retained almost intact, the principal change being the replacement of intercellular air. It seems evident that this rehydrated tissue can never attain the volume and character of the fresh tissue because death of the cells destroys the osmotic mechanism responsible for turgor. The remarkable thing is that the tissue can assume so nearly the structure it had immediately after it was blanched. This is apparently largely due to the ability of the cell walls to absorb water, swell and spring back into their original form. Prolonged blanching tends to reduce this ability.

Another mistaken idea is that exposure to the sun in the common process of sun drying "fixes the color" in fruits. During the overnight sulphuring tissues are killed, and sap is released which floods the intercellular spaces and replaces to varying degrees the intercellular air. Then, under the alternate warming and cooling that occurs during sun-drying, the bubbles are reduced in size and numbers and the cell walls are gradually softened. This allows the tissue to contract and eliminates practically all of the air. In other words, the physical changes produced rapidly by blanching are slowly brought about during sun-drying. However, when one compares blanched, sulphured, dehydrated products with sulphured, sun-dried ones, he finds that almost invariably the sun bleaches out the color and fades the surface layer. This is particularly true with peaches. The idea that sun drying fixes or enhances color is obtained by comparing unblanched dehydrated products with sun-dried ones. The blanched dehydrated products invariably have a brighter, more attractive appearance than do the sun-dried ones.

Gain Exceeds Loss

It must be recognized that steam or hot water blanching brings about certain losses from the tissues. This is especially true of fruits that bleed badly, such as cherries, peaches and prunes. Losses from large fruits requiring long blanching may also be severe.

Even in these cases, however, tests indicate that the improvements in appearance and keeping qualities more than balance the loss. This is particularly true in the case of large fruits where the losses are largely sugar. Replacement of the lost sugar is relatively inexpensive compared with loss of grade in the dried fruit product.

References

1. E. M. Mrak, H. J. Phaff, C. D. Fisher and G. Mackinney, *Food Industries*, April, 1943, pp. 59–62.

High-Protein Concentrate Can Be Obtained from Grass*

By J. T. SULLIVAN,† U. S. Regional Pasture Research Laboratory, State College, Pa.

By means of alkali extraction, high-protein preparations have been made, on a laboratory scale, from young grass. Such preparations have commercial possibilities, in time of protein shortage, as an animal feed ingredient

PROTEIN is the most expensive of the three major food constituents, and the demand for protein foods is great at the present time. Pastures furnish the cheapest source for cattle. Enormous quantities of protein-containing forage are unused annually by overproduction during lush periods of growth, in discarded lawn clippings, on ungrazed roadsides, and so forth. Surpluses may be restored to the soil for their fertility value as well as preserved in silage or hay. There is also a possibility of converting the protein into a less bulky and nonperishable form which may be used to supplement the protein in the diet of many animals. In England the use of grass protein as a human food has even been suggested.[1, 5]

Proteins are soluble in acids and alkalis, and some are soluble in salt solutions. Extraction and grinding of plant leaves with water will also yield solutions of proteins which may be precipitated upon heating or upon slight acidification.[2] No commercial uses are known to the author to have been made of these methods of separation of proteins from grasses, although at least one has been patented.[6]

This paper describes high-protein preparations which were made on a laboratory scale from young grass harvested in early spring. The alkali extraction method, similar to that of McLean[3] for the preparation of protein from peanuts, was used. The purpose of this article is to call the attention of feed producers to the possibility of producing such preparations on a commercial scale. The cost of such production is not known to the author. The feeding value of these preparations is yet to be determined.

Mixed Grass Sample

Clippings were taken from grass plots early in May. They consisted mainly of ryegrass, red top, timothy and weeds. They were dried by spreading in a thin layer in a warm room and then ground through a 2-mm. sieve on a Wiley mill. Their composition is given in the second column of the table.

An 800-gram lot of these air-dry clippings was placed in a 4-gal. crock and stirred into a paste with 7.75 liters of a 0.25 N solution of sodium hydroxide. The mixture was left standing overnight at room temperature. Sufficient hydrochloric acid was then stirred in to neutralize the greater part of the alkali. This was done to enable handling with bare hands. The mixture was then poured through cheesecloth and the liquid squeezed out by hand. The residue was spread out in a warm room to dry.

The filtrate and washings, about 20 liters in volume, contained a small amount of solid matter, the removal of which by filtration or centrifuging was tedious. The liquid was therefore allowed to settle and decanted from the solid matter which was discarded. The liquid had a pH value of 7.5 and was brought to pH 3.6 by the addition of 20 percent hydrochloric acid. A voluminous precipitate formed and settled out rapidly and was collected upon filter paper in a Buchner funnel. The excess liquid was removed by suction and the precipitate was washed with about 500 ml. of tap water acidified to about pH 3.0. The precipitate was spread out in shallow dishes in a warm room, whereupon it dried to a hard greenish mass which was ground in a mill. The yield of this substance was 111.65 grams, air dry. Its composition, given in the third column of the table, indicated that it contains 54 percent protein, or on the dry basis, 58.2 percent.

A small portion of this crude protein product was treated further. A 15-gram portion was extracted in a Soxhlet apparatus with 95 percent alcohol which removed large quantities of green material and then with petroleum ether which removed very little additional coloring matter. The final residue weighed 12.05 grams and contained 64.71 percent protein or 72.68 percent on the dry basis. It is referred to as the

* Contribution No. 56, of the U. S. Regional Pasture Research Laboratory, Division of Forage Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture, State College, Pennsylvania, in cooperation with the northeastern states.

† Physiologist.

Composition of Grass Samples and Yield and Composition of Products and Residue Obtained From Them.

	Ryegrass, red top, timothy, and weeds extracted with 0.25 N NaOH overnight				Kentucky bluegrass and white clover extracted with 0.18 N NaOH overnight			White clover extracted with 0.18 N NaOH one hour		
	Original clippings	Crude protein product	"Purified" protein product	Residue	Original clippings	Crude protein product	Residue	Original clippings	Crude protein product	Residue
Yield per kilo air dry clippings, gr.	.....	139.6	112.1	438	.....	158.6	516	.....	88.2	560
Moisture, percent	9.30	7.18	10.96	7.59	10.70	9.29	9.43	13.50	9.76	10.64
Total N, percent	3.62	8.65	10.35	2.88	3.36	7.65	2.60	4.58	9.67	4.82
Protein N, percent	2.85	"	"	"	2.96	"	"	3.88	"	"
Ash, percent	9.91	6.06	5.02	5.63	11.34	11.60	6.10	10.14	4.19	6.65
Cellulose, percent	15.31	0.20	.....	35.66	19.22	3.03	36.44	12.22	3.28	27.66
Lignin, percent	2.00	0.16	.....	5.33	2.84	1.13	5.77	2.40	1.05	5.58
N.F.E. plus fat, percent	40.86	32.34	18.95*	27.77	34.90	27.14	32.01	33.12	21.28	19.35
Carotene, p.p.m.	230	440	.....	70	184	244	70	168	130	92
Protein (N X 6.25) in percent dry wt.	24.93	58.24	72.68	19.50	23.52	52.71	17.94	33.09	66.97	33.71
Recovery of protein N of original grass	.....	42.4	40.7	44.2	.....	41.1	45.5	.....	18.6	59.0

purified protein product and its composition is given in the fourth column of the table.

In preparing the purified product by extraction with alcohol, the alcohol removed about 20 percent of the dry weight of the crude product but less than 4 percent of the total nitrogen. It may also be calculated that if the entire crude product were extracted in the same manner a yield of 79.86 grams of the purified product would have been obtained from the 726 grams of dried grass extracted.

The plant residue remaining after the extraction of the protein amounted to 350 grams, air dry. Its composition is given in the fifth column of the table.

Both total and protein* nitrogen were determined on the original plant material. About 79 percent of the total nitrogen was protein. Total nitrogen in the protein precipitates and in the residue is assumed to be entirely protein. Assuming, also, that only protein nitrogen is recoverable from solution by precipitation, it is seen that about 86 percent of it is accounted for, about half of this being in the protein product and half in the residue. Heating the grass with alkali or treating with stronger alkali would remove more protein from the residue, but little of this extra amount would be recoverable by precipitation.

Analysis indicated that the crude protein product was also high in crude carotene, although the amount appeared to decrease on storage. Some carotene remained in the residue.

Bluegrass and White Clover Mixture

Plot clippings consisting mainly of Kentucky bluegrass and white clover were collected in May and treated as before. A kilo of air-dry material was extracted overnight at room temperature with 8.5 liters of 0.18 N sodium hydroxide. It was filtered as before and washed four times with tap water. The extract was brought to pH 3.6 and the crude protein precipitate collected and dried. It weighed 158.6 grams and contained 52.71 percent protein on the dried basis. The composition of the original forage of the crude protein product and of the residue is given in the table.

White Clover

A 400-gram sample of white clover was treated with 2.5 liters of 0.18 N sodium hydroxide in the cold for one hour. It was filtered and washed twice with water. The precipitate formed at pH 3.6 was collected and dried. The yield was 35.3 grams and it contained 67.0 percent protein on the dry basis. The lower yield in this case may be accounted for by the shorter period of extraction. The composition of these fractions is also given in the table. The yields given in the table are based upon a kilo of grass.

Preliminary work on clover, timothy and mixed hays indicates that relatively smaller yields of concentrates of a lower protein content are obtainable from these materials than from grass collected in early spring.

Discussion and Conclusions

The extraction of dried grass with sodium hydroxide solution and the neutralization of the resulting solution with acid yielded a precipitate containing a high concentration of protein, a considerable amount of carotene and an insignificant amount of lignin and cellulose. Such a product is higher in protein than most protein concentrates, being exceeded only by those of animal origin. It is also higher than many animal feeds in carotene, a considerable part of the pigment in the grass having been absorbed by the protein precipitate. Its analysis indicates that such a product may have value as a protein concentrate for animals requiring high-protein, low-fiber diet.

Three such products prepared under slightly varying procedures with simple laboratory equipment are described and their composition and yields reported. A ton of dried forage of the type described in the mixed grass sample should yield about 285 lb. of this dried product.

Further purification of the crude product, as far as protein concentration is concerned, may be obtained by extraction with alcohol. By this process the green coloring matter is removed and the resulting product is tasteless, though nearly black in color. It contains over 72 percent protein on the dry basis, and a ton of forage should yield more than 220 lb. of this material.

The residual grass material may have some food value. It yielded about 875 lb. per ton. It is green in color and has the appearance of a palatable stock feed. The alkaline treatment alone should not have affected it adversely since such treatment has been shown to increase the digestibility of straw.[4]

The figures given apply only to the material reported. The yields and composition of the products would be expected to vary with the plant material used. Removal of the protein solution from the grass while still strongly alka-

(*Turn to page 137*)

Experimental Results of Preliminary Trials

1. A considerable part of the protein contained in grass is readily soluble in sodium hydroxide solution and may be precipitated from solution by acidifying with hydrochloric acid.

2. Although all conditions have not been studied, it appears that the amount of protein going into solution increases with the concentration of the alkali, with the temperature, and probably with the duration of the treatment.

3. Higher concentrations of alkali and higher temperatures cause a hydrolysis or other alteration of the protein so that smaller yields are obtained on acidification.

4. Low concentrations of alkali, as 0.25 normal, acting at room temperature, cause little hydrolysis of protein so that the yield of protein precipitated upon acidifying the extract is as great as when a more drastic alkaline treatment, such as 2.0 normal alkali in the cold or 1.0 normal alkali with heat, is used. Moreover, the milder treatment allows the undissolved residue to retain a quantity of protein which would otherwise be hydrolyzed and unaccounted for in the final products.

5. Though there may be differences in the isoelectric points of proteins from the same or different species of grass, the point of precipitation of a protein solution is not sharp. Complete precipitation seems to be obtained anywhere in a pH range as wide or even wider than 2.0 to 3.8.

6. The protein precipitate, obtained by extraction with sodium hydroxide and acidifying with hydrochloric acid is dark green, has a grassy flavor and is not palatable to the human taste. If the grass has been extracted previously with alcohol, the precipitate is tasteless. The same tastelessness is obtained if the protein precipitate is first prepared and then extracted with alcohol. In the latter case it is not necessary to treat such a bulky sample with alcohol.

7. The plant residue remaining after extraction of part of the protein is green in color and has retained some food value as determined by analysis.

The above observations were made during numerous extractions with small, 10 to 15 gram, samples, which did not, however, cover all possible conditions. Making use of the above information, several larger samples were treated and the results are reported in detail.

* Albuminoid nitrogen by A.O.A.C. official method.

The original locker plant of the Frozen Products Corp. with a partial view, in the background at right, of the structure recently added for expansion into processing, freezing and storage on a commercial scale. The building is designed for future extension.

New Competition for Freezers

Frozen food locker plant enters commercial field, and many more have the basic facilities and know-how to do likewise

By W. J. FINNEGAN, W. J. Finnegan Co., Jacksonville, Fla.

MANY of the country's frozen food locker plants embody the nucleus of sound and economical progress in the preservation of food by freezing. Nearly all of these plants provide a safe and low-cost means for the operator to branch out into the larger commercial frozen food field. While the present range of a locker plant's operation may be considered relatively small, the experience gained through the selection of suitable foods and the harvesting, processing, freezing and storing of these foods will be of inestimable value to the operator who chooses to extend his scope of operations to the commercial field.

Frozen Products Corp., Knoxville, Tenn., offers an example of a small locker plant well on its way toward bigger business. For several years the corporation has been engaged in food freezing and locker storage. In 1942 it had over 1,100 lockers in service. And during that year it froze and distributed over 1,000,000 lb. of food. The plant's location, in an area where a plentiful supply of proved varieties is grown, contributes greatly to high quality and rigid production economy. This proximity to its source of supply enables the plant closely to supervise planting, cultivation and harvest, as well as affording a short haul from field to plant. Under the label "Winter Garden," the corporation is at present producing several commercial frozen foods, including strawberries, wild blackberries, peaches, apples, string beans and corn.

Prior to and during the spring of 1943, the firm distributed a complete line of frozen foods to the institutional trade, including several large industrial plants, and also supplied a large retail business among public markets, grocers, delicatessens and the like. Frozen foods distributed by the company, other than those it produced, include car-lot quantities from Fairmont Creamery Co., Cherry Growers, Inc., R. D. Bodle Co., Atlantic Coast Fisheries Co., Booth Fisheries and other producers of quality frozen foods.

In line with its previous achievements and an increased demand, Frozen Products Corp. has extended its capacity for food handling, freezing and frozen-food storage. The major extensions and improvements consist of a new class A building with a 1,250,000-lb. frozen food storage capacity, receiving and shipping platform, a good processing room, liberal overhead dry storage, a multistage quick freezer and a refrigeration-machine room. The building and general arrangement of mechanical equipment readily lends itself to future extensions.

The frozen food storage room is insulated with rock cord board, moisture-vapor proofed and applied in strict adherence to the best method of envelope-insulation construction. The air cooling surfaces are arranged as a battery of overhead, full-flooded, liquid recirculating coils. A constant ammonia level is maintained by a Phillips' automatic liquid-level control. The temperature of the storage room is automatically regulated within a range of 2 deg. F. (minus 4 to minus 6 deg. F.) by a mercury-enclosed air-type thermostat. This controller automatically starts and stops a 6x6-in. twin-cylinder York compressor, driven by V belts from a 15-hp. motor. The ratio of cooling surface to the heat-transmission load is based on a 4-deg. F. temperature difference during peak

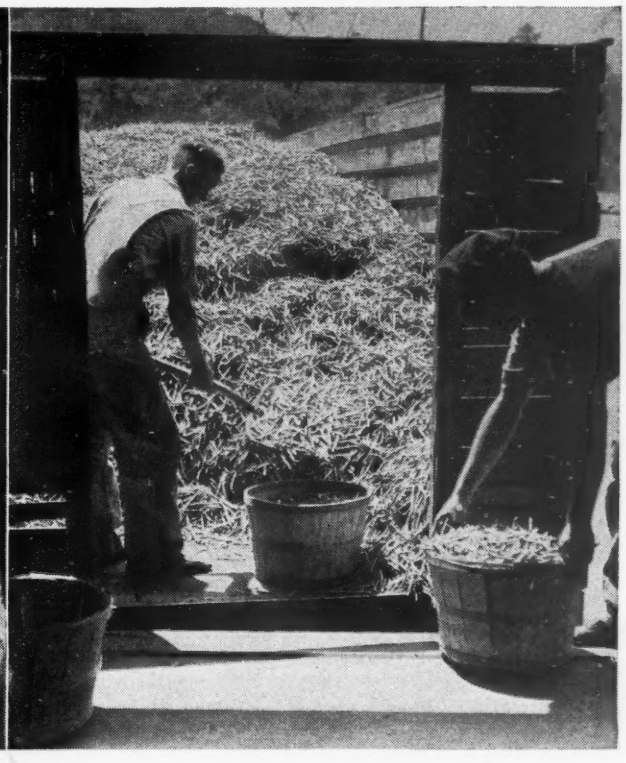
loads. This, in addition to a minimum fluctuation in the storage-room air temperature, indicates a prevailing air condition known to be optimum. All food handling prior to storage is done under normal atmospheric conditions.

The present quick freezing capacity is 2,500 lb. hourly. Refrigeration for freezing is supplied by a 9x9-in. Frick twin-cylinder compressor, V-belt driven by a 75-hp. motor at 300 r.p.m., and operating under a 12-lb.per-square-inch suction and a 165-lb. condensing pressure. Obviously, the food freezing capacity can be boosted substantially simply by increasing the gas-handling capacity of the refrigeration machinery. This may be accomplished either by adding another compressor or by compounding the compression with a booster or multistage compressor, the selection of which would depend upon available space, initial cost, power rate and relative overall operating costs. In this connection it is interesting to note that the prevailing power rate in this instance is 8 mills per killowatt-hour.

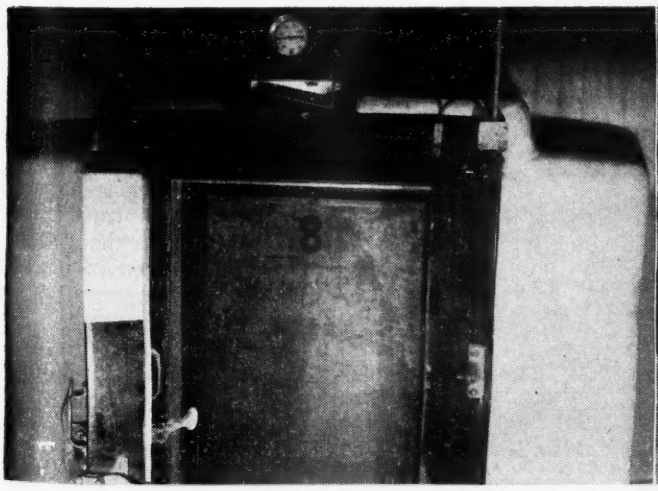
The production and distribution of frozen foods on a fairly large commercial scale will, of its own accord, present many problems foreign to the usual operations of a locker storage plant.

The need and importance of a more rigid economy, because of the comparatively small profit margin, will necessarily compel a clearer understanding of the requirements necessary to fill the public demand. In addition each operator will find numerous and varied conditions peculiar to his particular surroundings.

Strawberries packed in 30-lb. paperboard cartons are placed in multistage freezer with approximately 2-in. spaces for air circulation around each carton.



Unloading string beans at the receiving platform after a short haul from the fields. It is this proximity to the growing areas that gives Frozen Products Corp. a great economical advantage.



The loaded truck is ready to be taken from the discharge end of the multistage freezer. The pushbutton on upper right of door is used to advance trucks on conveyor from stage to stage in the freezing process

Tennessee Blackemore strawberries are conveyed through final inspection before being packed for freezing and storage. Over 1,000,000 lb. of food was frozen and distributed in 1942 by Frozen Products Corp.

Mobile Shops Keep More Trucks Rolling

Trucks equipped with repair facilities visit branch plants and make minor repairs on spot. Fewer trucks are sent to central shops, and the time out for repairs is reduced. This means more trucks in service and less trouble from wartime shortage of vehicles

WARTIME restrictions having made it almost impossible to buy new trucks or to obtain repair parts for old ones, the problem of maintaining truck fleets in the food field has become quite acute. To help meet this situation, Sheffield Farms Co., Inc., has built a mobile repair shop. And the company has been successfully using this garage on wheels for 18 months to help maintain the large fleet of motor vehicles which it operates as the milk and dairy products subsidiary of National Dairy Products Co. in Metropolitan New York.

Since the shortage of trucks is likely to become even more critical before it improves, the results obtained through the use of the mobile repair shop should be of value to both large and small truck users in the food field.

To better apply the principles utilized in this traveling repair shop, it may help to outline the factors which led to its construction and use. The inception of the idea dates back to shortly after Pearl Harbor, when it became apparent that civilian truck users would be faced with restrictions on new vehicles, repair parts and even manpower in order to provide our armed forces with adequate automotive equipment.

Sheffield has a large wholesale and retail milk business, and its big fleet of retail delivery trucks operates from approximately 50 retail branches to make door-to-door deliveries. The milk is pasteurized and bottled at several main plants and then transferred by large refrigerated tractor-drawn trailers to the retail branches.

There the milk is kept under refrigeration, usually in the same trailers in which it has been transferred, until it is unloaded directly into the retail trucks which are kept in a garage portion of the branch building. These trucks deliver the milk to customers on regular routes and then return to be garaged at the branch building.

Looking into the Sheffield Farms mobile repair shop from the rear. The two-mechanic crew, at work on a radiator to be installed in the field, is surrounded by various spare parts, equipment, bins and a workbench with an electric drill and vise. A mobile unit such as this makes it unnecessary to take trucks out of service and send them to a central repair shop.

Prewar System Economical

Sheffield Farms maintains several large motor repair shops, including one at its main office and plant in Manhattan and another at its large combined plant and branch building in Jamaica, L. I. These shops do the main overhauling and rebuilding work on the tractor and trailer transfer units, the large wholesale delivery trucks and the small retail route trucks. This centralization of major repair work reduces the cost and also the size of the stock of repair parts which has to be carried, as the retail branches need not be equipped with major repair tools, equipment or stock.

Ordinarily, such a centralized system of maintenance is the most economical which can be devised. However, it is necessary to transfer the retail route trucks from the branches to the main shops at certain specified periods, according to the type and make of truck, the kind of route covered and the daily mileage run. And every time a retail branch truck is transferred to the central repair shop, a truck to replace it has to be sent to the branch. This is done so that the route from which the transferred truck is taken may continue to operate. According to peacetime standards, this is again the most economical procedure.

Spares Cut 50 Percent

But under present war conditions, spare trucks are becoming more scarce. This is primarily due to the company's inability to purchase new trucks, and the increase in the time that trucks undergoing repairs are out of service because of delays in obtaining replacement parts. Thus, the number of spares available for transfers to branches has been reduced. In some periods the reduction has been as high as 50 percent.

Mobile Unit Solves Problem

It has become necessary, therefore, to find some way to keep all the regular retail routes running with the number of spares available. The mobile repair

shop is the answer to that problem.

The mobile unit is staffed by two, good, all-around mechanics, one of whom drives the truck and operates from the company's Jamaica plant. Each unit serves eight retail branches. The unit is made up of a panel body mounted on a typical 1½-ton truck, fitted with a group of open-faced bins for screws, nuts, bolts and small parts, a paint locker, a workbench and a wood and iron rack, all of which are shown in the accompanying illustrations. The equipment and tools include a vise, electric drill, anvil, drop-lights, an oxy-acetylene welding outfit with hose and cutting tips, jacks, a wooden horse and miscellaneous tool boxes.

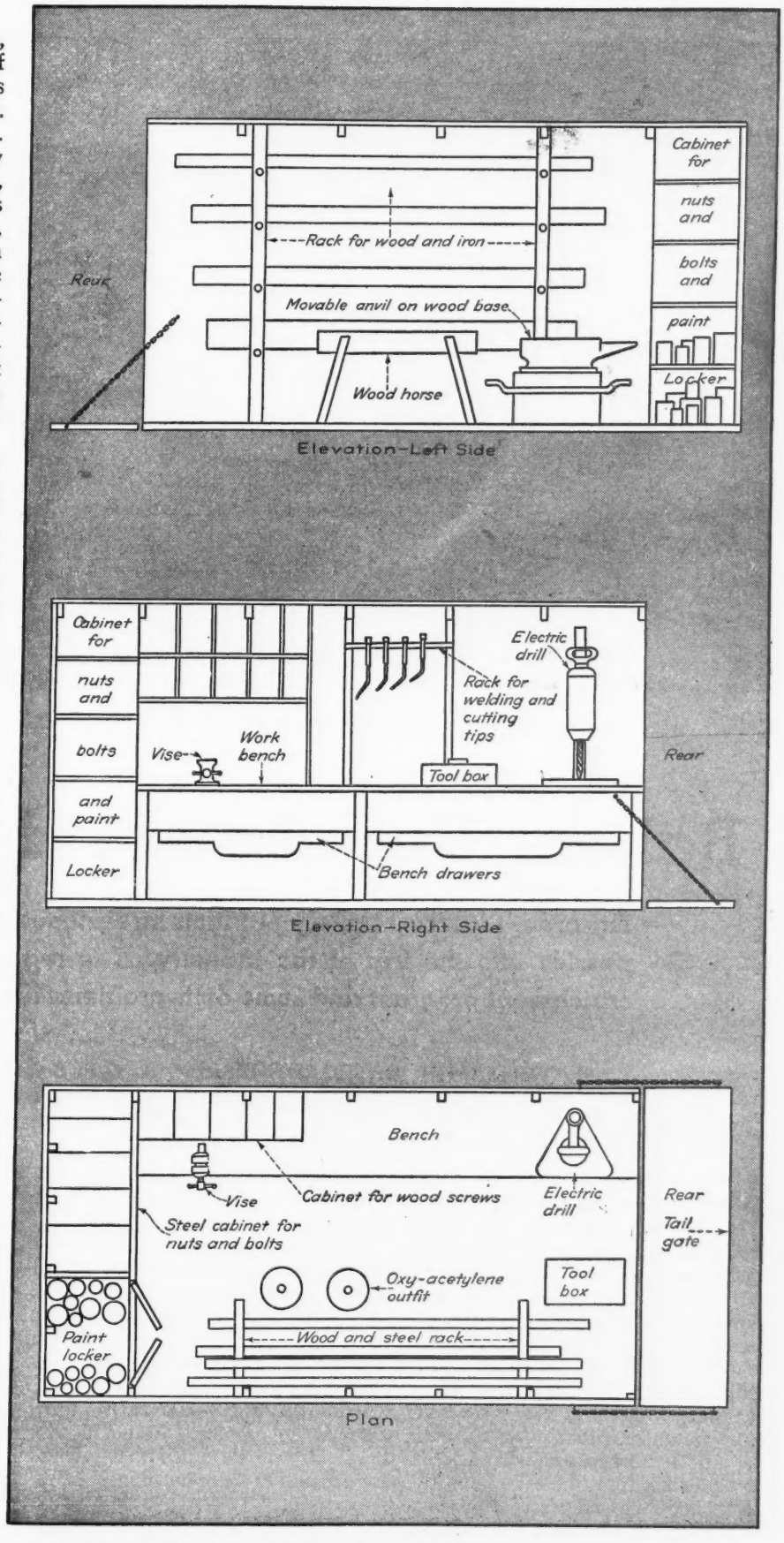
Because of the scarcity of good mechanics, as well as a lack of adequate tools and parts at the individual branches, the mobile unit takes both manpower and repair facilities directly to the branch. This procedure catches many small needed repairs before they grow into big jobs and reduces the frequency at which it is necessary to take the trucks out of service at the branch and transfer them to the nearest centralized repair shop.

As a result, the existing number of spares has been sufficient to keep the retail routes running without interruptions. The trucks are now transferred to the centralized shops only for such major maintenance jobs as motor or other unit replacements, frame straightenings to repair accident damage, or any other work the crew of the mobile unit cannot do.

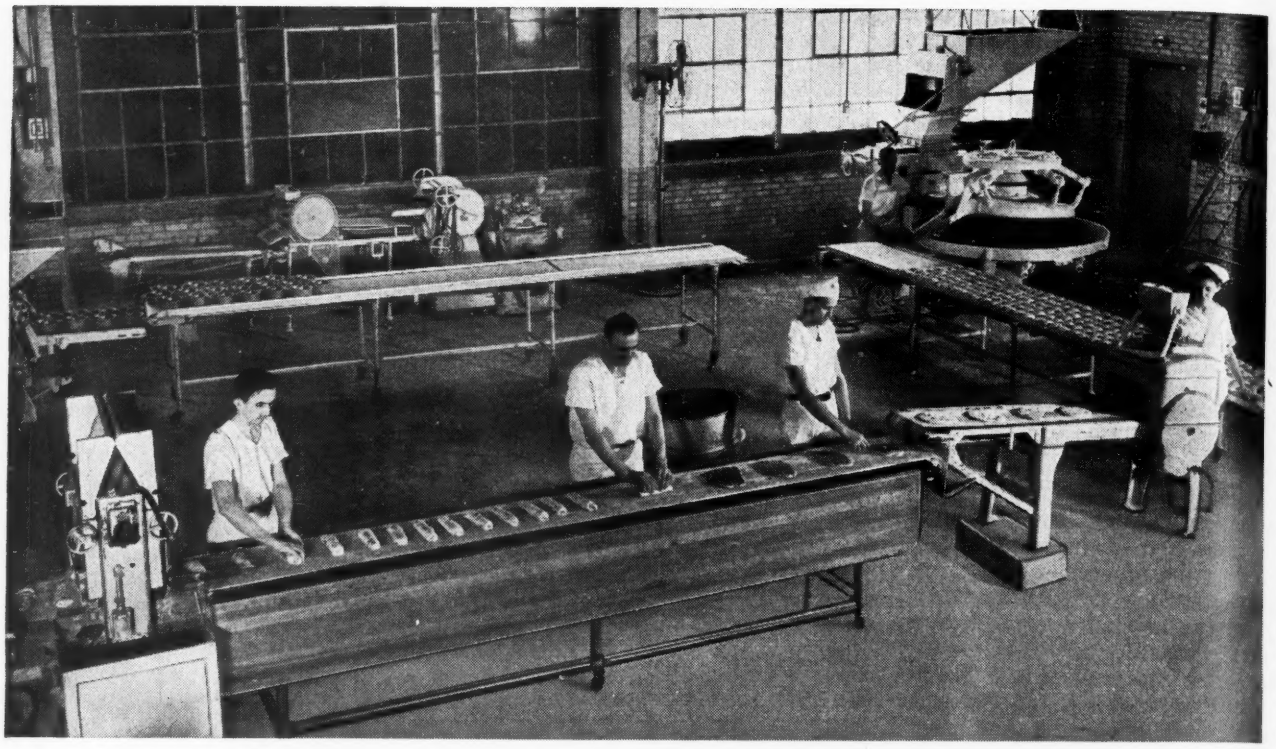
The application of this principle of maintenance is obvious in other large fleets in the food field which operate wholesale or retail branches. It is less direct in single-plant or branch operations, although the principle may be applied by having some outside agency, such as the truck manufacturer's branch service station, perform the work.

To supplement the work of the mobile unit in helping to reduce the length of time trucks are laid up for repairs, a widespread conservation program was adopted among Sheffield drivers. As outlined in detail in Food Industries for September, 1943, this plan stressed accident prevention as well as the conservation of tires and gasoline. If accident frequency and severity were permitted to increase over prewar levels, the increase in out-of-service time for accident repair might nullify the reduction obtained through the use of mobile units.

The adoption of such maintenance procedures by fleet owners in the food industries will be even more necessary in the critical days ahead than they were during 1943.



Drawings of the mobile repair unit, including a plan and elevation views of the right and left sides. This repair shop on wheels has helped to cut down the time the company's retail milk trucks are laid up for repair and enable its limited number of spare trucks to keep the fleet running. All details of the equipment fitted and the tools used are shown above. The equipment and tools include a vise, electric drill, anvil, an oxy-acetylene welding outfit, jacks, a wooden horse and miscellaneous tool boxes.



Mechanized coffee cake makeup unit. Vitamins and iron are to be added to coffee cake beginning May 1

Bakers' Enrichment Headaches

The order that most bakery products be enriched has tossed some puzzles into the lap of the industry. The requirements of the enrichment program and some of its problems are discussed here

By WILLIAM H. CATHCART, Director, A. & P. Bakeries Laboratory, The Great Atlantic & Pacific Tea Co., New York, N. Y.

ADDITION of vitamins and minerals to food products is not new, but some of the problems are new that were introduced by the government's enrichment program for bakery products. This is especially true of the requirements of Amendment 5 to Food Distribution Order No. 1 calling for the enrichment of all yeast-raised products (except crackers and biscuits), doughnuts, crullers and fried cakes. But before we go into that in detail, let's take up the bakery-products enrichment program from the beginning.

Enriched flour and bread came first, and since these have been reviewed by various investigators,[1] they will be discussed only briefly here.

Enriched Flour

The development of the enriched flour program was crystallized into standards for enriched flour which became effective October 1, 1943. These standards are given in Table I.

Both minimum and maximum figures are given. It is understood that the reason for the maximum figures is to prevent fortification of flour to the point where it would be more of a medicine than a food; also, they prevent abnormal advertising claims. These maximums have been carried through to proposed standards for bread. It will be noted that calcium and vitamin D are optional ingredients.

Enriched Bread

Standards for enriched flour have been carried through and made to correspond to proposed standards for enriched white bread. The proposed standards for enriched white bread are set up so that if a baker makes white bread by using enriched flour, he would have values for the various vitamins and minerals as listed in Table II.

The maximums on riboflavin and calcium are greater in proportion to the minimums than on the other nutrients. This is due to the fact that the bakers use milk in many of their products, which supplies both riboflavin and calcium and which would necessitate a higher maximum in proportion to the minimum than for the other nutrients.

These proposed standards were published in the *Federal Register* for August 3, 1943. To date they have not been made effective. However, the baker has actually been making white bread according to these standards since October 1, 1943, because FDO No. 1 requires that all white bread be enriched to the extent of the white flour present.

TABLE I—Standards for Enriched Flour.

	Milligrams per pound of flour	
	Minimum	Maximum
Required		
Thiamine	2.0	2.5
Niacin	16.0	20.0
Riboflavin	1.2	1.5
Iron	13.0	16.5
Optional		
Calcium	500	625
Vitamin D (U. S. P. units)	250	1000

TABLE II—Proposed Standards for Enriched Bread.

	Milligrams per pound of bread	
	Minimum	Maximum
Required		
Thiamine	1.1	1.8
Niacin	10.0	15.0
Riboflavin	0.7	1.6
Iron	8.0	12.5
Optional		
Calcium	300	800
Vitamin D (U. S. P. units)	150	750

TABLE III—Comparison of Thiamine, Niacin, Riboflavin and Iron Contents of Various Bakery Products.

(Figures in milligrams per pound)

	Bread			Sugared doughnuts (Baking powder)		Coffee cakes* (Average of various types)	
	Whole wheat	Unenriched white	Enriched white (minimum)	Unenriched flour used	Equivalent of enriched flour used	Unenriched flour used	Equivalent of enriched flour used
Thiamine	1.35	0.25	1.1	0.45	0.9	0.50	1.0
Niacin	12.0	3.5	10.0	3.0	7.5	5.5	10.0
Riboflavin	0.55	0.35	0.7	0.40	0.7	0.85	1.2
Iron	10.0	3.5	8.0	6.0	11.0	6.0	11.0

* Values for coffee cake are quite variable due to various types and due to different kinds and amounts of fillings.

Other Products

Amendment 5 to FDO No. 1 (effective date for adding vitamins and minerals to all products except white bread, rolls and buns postponed to May 1, 1944) changes the enrichment requirement of FDO No. 1 to include all yeast raised products (except crackers and biscuits), doughnuts (either yeast-raised or baking powder raised), crullers and fried cakes. The amendment requires that the baker make all of these products by using enriched flour or its equivalent. The baking and allied industries have collected considerable information in regard to losses of the various vitamins and minerals during processing in bread. However, now that this requirement is extended to include sweet yeast-raised goods and doughnuts, more information needs to be obtained.

Also, up to this date (January 17, 1944), there has been great confusion regarding whether the baker may call any product other than white bread, rolls or buns "enriched," even though he uses enriched flour. The latest ruling from the Food and Drug Administration is that the only products that can be labeled "enriched" are white bread, rolls and buns. Since the baker pays for the added vitamins and minerals, it seems he should be able to derive some benefit in advertising statements.

It would have been much better for the consumer if standards were set up on the finished baked products. Such a procedure would assure the consumer of getting a definite quantity of the various vitamins and minerals. The way the order stands at present, all that is required is the addition of certain quantities of vitamins and minerals. The order places no control over the amounts of these nutrients left in the finished product.

Orders are changed so rapidly these days and amendments made so quickly that it might very well be that Amendment 5 to FDO No. 1 is changed before this article is published. In fact, during the writing of this article, part of the enrichment requirements of Amendment 5 were postponed until May 1st.

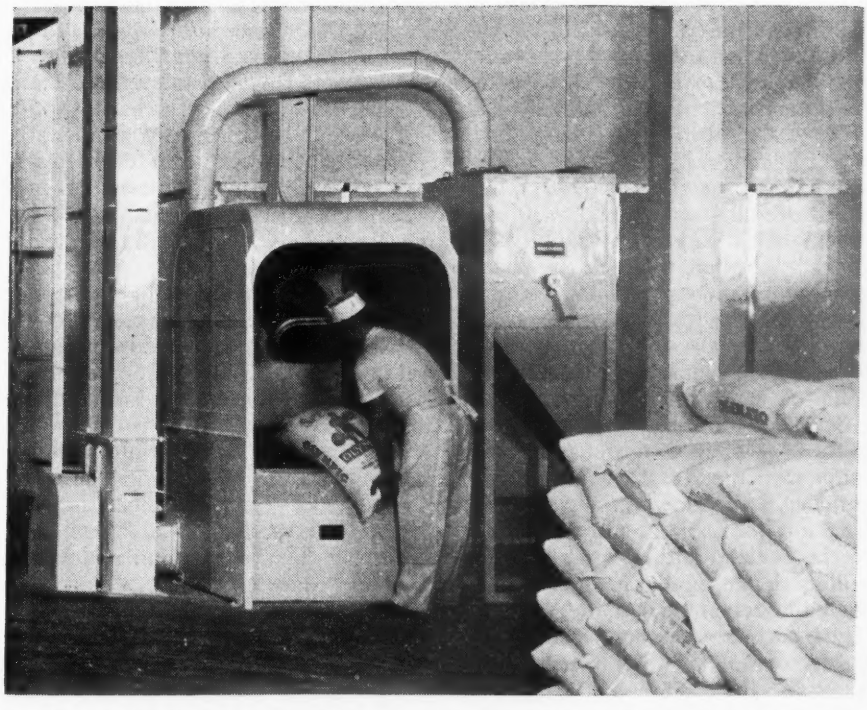
Enriched White Bread vs. Whole Wheat Bread

Enriched white bread is compared with whole wheat bread in Table III. In addition, values are given on baking powder-raised doughnuts and coffee cake made according to the new enrichment order mentioned above and also on the same products made without added vitamins and minerals. The values for whole wheat bread are taken from many different reports in the literature.

Comparing the figures for enriched white bread and whole wheat bread, the enriched white bread is nearly equivalent to the levels of the whole wheat bread. It will be noted that the thiamine, niacin and iron content of whole wheat bread is about 20 percent higher than that of enriched white bread. However, wheats show a tremendous difference in their thiamine, niacin and iron contents, and many workers consider the minimum values for enriched bread to be the approximate whole wheat levels. It will also be noted that on the average there is more riboflavin in enriched white bread than in whole wheat bread.

Other less well known vitamins have not been considered in the enrichment program, particularly due to the fact that little is known about them. However, some information on losses of such vitamins as B_6, pantothenic acid and choline shows that milling losses are small.

There is little evidence indicating that minerals other than calcium and iron need to be added to the diets of the American people. Iron requirements are taken care of in the enrichment program. And although calcium is not mandatory, most white bread is made with milk solids and it has been found that average white bread on the market will contain 360 mg. of calcium per pound. This is above the minimum



Continuous blender with flour sack cleaner and dust collector. The operator is dumping flour. If enriched flour is used at the bakery, it would be added at this point.

requirement for enriched bread and mainly comes from the milk that is added to the bread. Calcium is also contributed by the general use of dough conditioners.

Thus, there is little indication at the present time that these lesser known vitamins should be added back to white bread, and it can be concluded that the better known vitamins and minerals of whole wheat have been added back in the making of enriched white bread.

It recently has been shown[2] that white bread made without milk is deficient in lysine, valine, riboflavin and mineral salts. However, in the same work it is shown by rat-feeding tests that enriched white bread made with dry skim milk solids is nutritively equal and somewhat superior to whole wheat bread for the promotion of growth.

Doughnuts and Coffee Cake vs. Enriched White Bread

Table III shows that doughnuts in which enriched white flour has been used are not equivalent to minimum standards on thiamine and niacin for enriched white bread. The thiamine content of coffee cake in which white flour is used is below the minimum standards for enriched white bread. Both the doughnuts and the coffee cake are equivalent to enriched white bread in the other factors, due to the use of milk, eggs and other ingredients containing these nutrients.

Addition of Ingredients

In order to produce enriched flour, it is necessary that synthetic vitamins and minerals be added. Part of the enrichment can be obtained naturally from the wheat berry. The greater the proportion obtained naturally, the darker the resulting flour. In general, most millers and bakers are obtaining only a small quantity of their enrichment naturally from the flour.

The baker can add vitamins and minerals in various ways. He can obtain them by using enriched flour, by using yeast fortified with these vitamins and minerals, or by using tablets or a powdered preparation containing a definite quantity of the vitamins and minerals. From the wording used in FDO No. 1, it is obvious that the simplest method for the baker is to use enriched flour. However, many millers have not been able to add enrichment to the flour uniformly, and also many millers charge more for enriched flour than the actual cost of the vitamins. Thus, it is more economical for the baker to use the other methods. In addition, the government holds the baker, and not the miller, responsible for the quantity of vitamins and minerals present in his product. These are the reasons why few bakers have gone to enriched flour up to this time.

Tablets have been found to be a very uniform method of enrichment. This will undoubtedly prove to be just as true when adding vitamins and minerals to coffee cake and doughnuts as it is when producing enriched white bread.

Loss of Nutrients in Baking

In processing bread, the only nutrient showing any appreciable loss is thiamine. The losses of riboflavin, niacin and iron are negligible. Reports on the loss of thiamine range from 5 to 30 percent. It is believed that a good average is 20 percent. This means, of course, that bakers must add approximately 25 percent more thiamine in making bread than required. On toasting bread there is still further loss of thiamine. This may be as much as 25 percent, depending upon the degree of toasting. Average medium toast shows approximately 17 percent loss. There are no data showing any appreciable loss of riboflavin, niacin or iron during toasting.

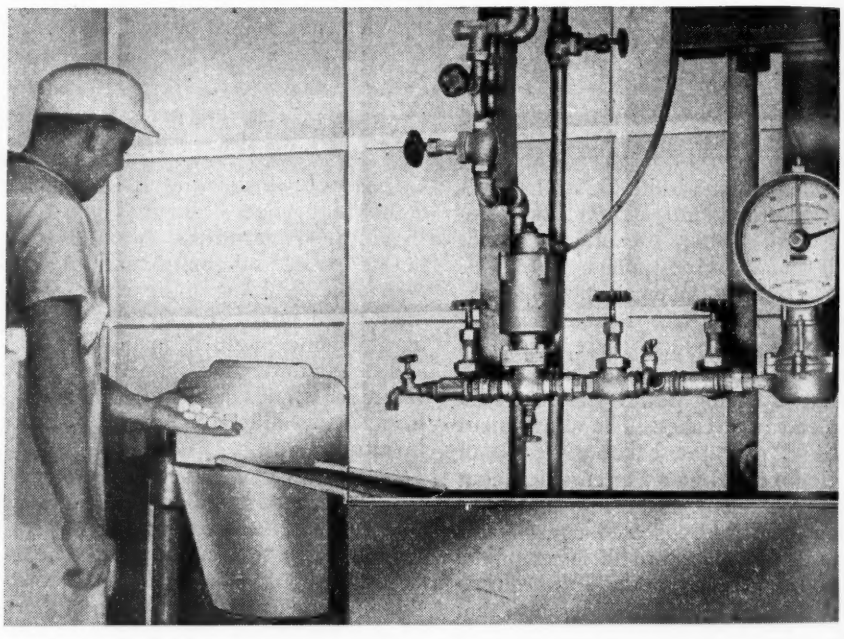
At the present writing, information is just beginning to become available on the losses during the processing of other products than bread. Data indicate that losses of thiamine in doughnuts and coffee cake will run from 25 to 45 percent. It is believed that average losses will be some place between 30 and 35 percent. In the case of doughnuts, the greater losses are found with the smaller quantity of vitamins added.

In the majority of experiments with doughnuts, riboflavin does not show any loss. Niacin and iron have shown losses, however, in all of the experiments. It is believed that these results are due to experimental error in that all of the niacin and iron cannot be determined, perhaps due to the high fat content of the doughnut. There is also some indication that niacin is lost in drying doughnuts and coffee cake.

Experience as to losses of riboflavin, niacin and iron in coffee cake is about the same as with doughnuts.

These high losses on thiamine further indicate that government would do well to reconsider the addition of vitamins and minerals to doughnuts and coffee cakes and, in place of this, perhaps increase the minimums for the enrichment of white bread. If the above losses of thiamine are verified by further work, the amount of thiamine destroyed by its addition to doughnuts and coffee cakes will be no meager figure. Considering the large demand for thiamine at the present time, it might be well to consider putting this vitamin into products where processing losses are not so great.

Fortunately, this problem is not beyond solution, as it might be possible to put the enrichment in the icing of the coffee cake and in the sugar on the doughnut. At least such a step is worth some serious consideration.



Adding enrichment tablets to the emulsifier to be suspended in water and then incorporated into the dough at the time of mixing

References

1. J. A. Tobey and W. H. Cathcart, *Industrial and Engineering Chemistry*, vol. 33, 714, 1941; W. H. Cathcart, *Industrial and Engineering Chemistry*, vol. 35, 66, 1943.
2. R. F. Light and C. N. Frey, *Cereal Chemistry*, vol. 20, 645. 1943.

A-B-C's of Coliform Control

An easy lesson in practical bacteriology. Foremen and workers will find it useful. It teaches how to protect the quality of liquid foods

By DAVID LEVOWITZ, Director
New Jersey Dairy Laboratories, New Brunswick, N. J.

MANY foodstuffs offered for sale to the armed forces and Lend-Lease must be demonstrated to be free from coliform organisms in specified quantities. Some suppliers have had very little trouble from this specification. Many, however, are ready to testify, on the basis of their products' analyses, that coliform control is an impossibility. It is—if the men who clean and sterilize and process are not taught the relationship between their duties and the problem. A perfect system for coliform control can be made useless by anyone's unintentional carelessness.

This article is designed to instruct dairy plant personnel in the prerequisites of coliform control. The principles involved are, also, applicable to other types of food processing systems. Technical language has been avoided as much as possible, to permit direct reading with a minimum of digression for further explanation. Paragraphs are numbered to facilitate cross reference.

Coliform is a bacteriologist's short term meaning bacteria of the colon-like group of organisms that come from dirt and the intestines of animals, including man.

Liquid food products—milk or its products, beer, wine, fruit juices, beverages or any liquid that can be contaminated can be safeguarded from coliform by the methods explained in this article. Here is a system of sanitary control that has worked in many a plant, and can be used in all liquid-food plants.—*The Editors.*

Bacteria and Their Types

1. Bacteria are tiny plants, so small that when magnified a thousand times, they seem to be about a twentieth of an inch long. A single "bacterium" is called a "vegetative" (growing) cell. There are many varieties of bacteria. They are affected differently by heat and cold.

2. All vegetative cells are killed if steamed at 15 lb. pressure (250 deg. F.) for 20 minutes, or dried at 320 deg. F. for an hour. Most bacteria merely stop growing when frozen; only a few types are killed by 32 deg. F.

3. The temperature range in which a bacterial variety grows best is called its "optimum." Some varieties have narrow optimum zones—others, broad. Some organisms can adapt themselves to widely altered conditions; most cannot. Bacteria which grow rapidly at temperatures just above freezing are "cold-loving" or "psychrophilic." Those which grow at room temperature are "mesophilic," while the "heat loving" types which grow above 120 deg. F. are called "thermophilic."

4. Many varieties are killed when heated much above their optimum temperatures. Those which are not are "heat resistant"—"thermoduric." Both the temperature and duration of exposure are measured to define heat resistance. Some bacteria, when deprived of moisture or food, or exposed to temperatures not suitable for growth, convert to nongrowing "spores." These are generally very heat resistant. Spores return to normal vegetative form when growing requirements are restored. Many spores survive 15 lb. of steam pressure for 20 minutes; they convert to vegetative cells after such treatment. A second steaming will then destroy them.

5. Disease-producing bacteria are called "pathogens." Their optimum range is, as a rule, narrow, around body temperature. Most pathogens are easily killed by temperatures much above their optimums; lower temperatures may retard or stop growth, but rarely destroy them.

6. The vegetative cell, in the presence of food and moisture, "grows." Growth is shown by one cell splitting to form two bacteria. Under optimum conditions, bacteria may double in number every five minutes. The time interval between cell divisions is referred to as a "generation time." A food for bacteria is called a "culture medium." A concentrate of one variety is a "pure culture"; of more than one, a "mixed culture," or merely a "culture."

7. "Sterilization," bacteriologically, is the process which destroys cells, vegetative or spore. Sterilization is accomplished by heat as reviewed above (Nos. 2, 4), or by chemicals. Metal-containing salts are very effective destroyers of bacteria. But since such salts are poisonous to humans, they are not applicable to food plant use. Chlorine-containing compounds—solutions of chlorine gas in water, sodium hypochlorite, calcium hypochlorite and chloramine—are quite universally approved for this purpose.

Bacteria and Milk

8. Milk is formed in the four chambers of the cow's udder. Many varieties of nonpathogenic bacteria are found in the udder tissue and in the milk from normal, "healthy" cows.[1] These organisms enter the udder from the cows' other tissues, by way of the blood stream; as well as from outside the body through the teat canal. Pathogenic organisms may be found, too, in the udder and milk from apparently healthy animals. Tuberculosis bacteria were frequently noted before the present "eradication" program was adopted.

9. Bacteria from outside the udder come from dust or dirt particles shaken off the cows' udder and flank hair, from the straw or shavings used as bedding, from the milkers or other handlers (if they are careless), from feeds, and from the milk-handling equipment. Milk is an excellent culture medium. If it is not cooled promptly to below 50 deg. F., bacteria will thrive.

10. Pasteurization, as applied to milk and cream, is a heating process (142 to 145 deg. F. for 30 minutes, or 161 deg. F. for 16 seconds) designed to kill all pathogens which may be present, regardless of origin. The pasteurization treatment is much more severe than actually is necessary—to provide a substantial factor of safety. A chemical test, the rapid phosphatase method,[2] is conveniently used to check adequate pasteurization of milk; the presence of a trace of raw milk, or slight under-heating or under-boiling, can be determined rapidly and accurately.

11. The pasteurization process kills many nonpathogenic varieties, as well as all disease producers. The types not destroyed are "thermoduric." Laws demand that pasteurized products be cooled to temperatures below 50 deg.

F., directly after the heat treatment, kept there, or below, until delivered to the consumer. This will retard the growth of organisms which have survived pasteurization. Laws demand that the equipment contacted by pasteurized product be sterile, and automatically operated to prevent the entrance of pathogens into adequately pasteurized products. Contamination *after proper pasteurization* is clearly shown if coliform organisms are recoverable from a milk or cream which yields a satisfactory phosphatase test.[3]

The Coliform Group of Bacteria

12. The "coliforms" are the members of two closely related families of bacteria. One type is found regularly in the soil. Soil dust is carried everywhere, by air currents. Coliform organisms of the soil type can be found everywhere, therefore, unless precautions are taken to destroy them. Equipment which can not be sealed from the air should be sterilized immediately before it is used. The other type of coliforms is always found in the intestinal discharge (manures) of all animals.

13. Soils are fertilized by manures. The "body" type of coliform bacteria grows best in the range between 85 and 110 deg. F., while the soil type's optimum is between 60 and 85 deg. F. Both types can grow well at temperatures below their optimums. "Body" organisms grown at lower temperatures for a number of generations ultimately develop the characteristics of the "soil" type.[4]

"Body" type organisms frequently get into freshly drawn milk from manure or bedding caked on the cow's flank and udder hairs and loosened at the time of milking. The regulations that require the brushing, washing and wiping of udders before milking and the frequent clipping of udder and flank hair are difficult to enforce, especially when there is a shortage of milk.

14. "Body" coliforms sometimes come from inside the healthy udder. The presence of either, or both, coliform types is common in raw milk. Freshly produced certified raw and equivalent special types of milk are the only ones subjected to a coliform limitation. These milks are produced under rigid supervision, and with every precaution. If such products show more than 10 coliforms per 1 ml. (ml. = millimeter – about ten drops), the animals responsible for such contamination must be identified and isolated.[5] Coliforms are not pathogenic; if they were, their presence, in any quantity, would not be tolerated in certified raw milk.

15. Coliform growth is stopped by freezing. Coliforms are destroyed by pasteurization. They are not spore formers. Bacteriological literature reports some strains which will survive pasteurization—but these varieties are rare in dairy products. Dairy products suspected of harboring heat resistant strains are readily tested by pasteurizing them in the laboratory (where later contamination from any coliforms is readily avoided).

16. Phosphatase reactions are recorded in "units." The recovery of any units proves that the whole, or a part, of the pasteurized batch has not been exposed to a full heat treatment. If the unitage is due to slight under-holding or under-heating of the entire batch, sufficient heat may have been applied to destroy all coliforms. If, however, it is due to the entrance of raw or grossly underpasteurized material into a fully pasteurized product, coliforms will be found. Raw milk must not be permitted to leak into batches being pasteurized. Partially heated material must be kept from leaking past the pasteurizer gate valves. Foam formation in pasteurizers should, preferably, be prevented; if it is impossible to do so, the foam should be heated.

Cleaning and Sterilizing Processing Equipment

17. Coliforms in the raw material are destroyed by adequate pasteurization. The finished, properly pasteurized product will not show coliforms if the equipment which carries it from the pasteurizer gate to the end of the system does not possess any of these organisms, and if the handling during processing does not introduce any. Equipment which is not protected from air currents should be sterilized just before it is put to use. If sterilized much in advance, air currents will reseed it with bacteria, and the interval until it is used will serve as an incubation period. Equipment must be clean. *If it is not clean it cannot be rendered coliform-free by practical plant sterilization methods.*

18. Heat sterilization (15 lb. of steam—250 deg. F—for 20 minutes, or 320 deg. F. for 60 minutes, dry) is both extravagant and impracticable; but it is the only means by which coliform on dirty equipment can be destroyed. Equipment which possesses even a slight film of oil—sufficient to prevent rinse-water from draining freely —is bacteriologically dirty. Such films prevent contact between the sterilizer and the surface to be sterilized. They increase the heat resistance of organisms by acting as insulators. Even a thin accumulation provides ample food for cell growth; bacteria don't need much.

19. Coliforms on equipment surfaces may be killed by sufficient exposure to hot water or chemical solutions. When the equipment is dirty, only the surface of the dirt (oil film or other accumulation) is rendered coliform-free. The continued passage of dairy products will wear away some of the dirt, liberating the bacteria previously protected. To render the equipment truly coliform free, all equipment surfaces must be cleared of any accumulations which would interfere with full contact between the sterilizer and the permanent metal surface.

20. Equipment which handles hot dairy products will accumulate "milkstone" deposits unless cleaned daily with a milkstone remover. Acids are generally employed for this purpose—milkstone is composed of alkaline materials (which are not dissolved by alkaline detergents.) Milkstone formations are rich sources of thermoduric and thermophilic bacteria, and provide excellent protection for coliforms. Equipment used with cold dairy products develops a greasy coating which contains dairy protein (casein) as well as fat. This is removed by thorough brushing with the usual alkaline detergents. Cleaning should be started before the dairy product dries on.

21. Cleaning is made easier if a "soft" water supply is available. "Wetting agents" used in the first rinse water and with the detergents (acid and alkali) save much cleaning time. After the cleaning has been completed, a small amount of wetting agent in the final rinse water leaves the equipment surfaces perfectly "clear draining." If the surfaces are protected from oil fumes, they are ready for sterilization just before processing begins. (Equipment in plants located in industrial areas will develop a non-clear-draining oil film from exposure to air.)

22. The practice followed in many plants—sterilizing individual sections and then hooking them up—will never result in satisfactory elimination of coliforms. Pipe ends, fittings and other parts are contaminated by the handling during connection. The system will be fully sterilized if the sterilizing agent is brought into full contact with all surfaces after the equipment has been completely hooked up. (The individual pieces of equipment are dealt with later on.) Any manual handling of the system after sterilizing should be preceded by sterilizing the hands followed by sterilizing the parts manipulated.

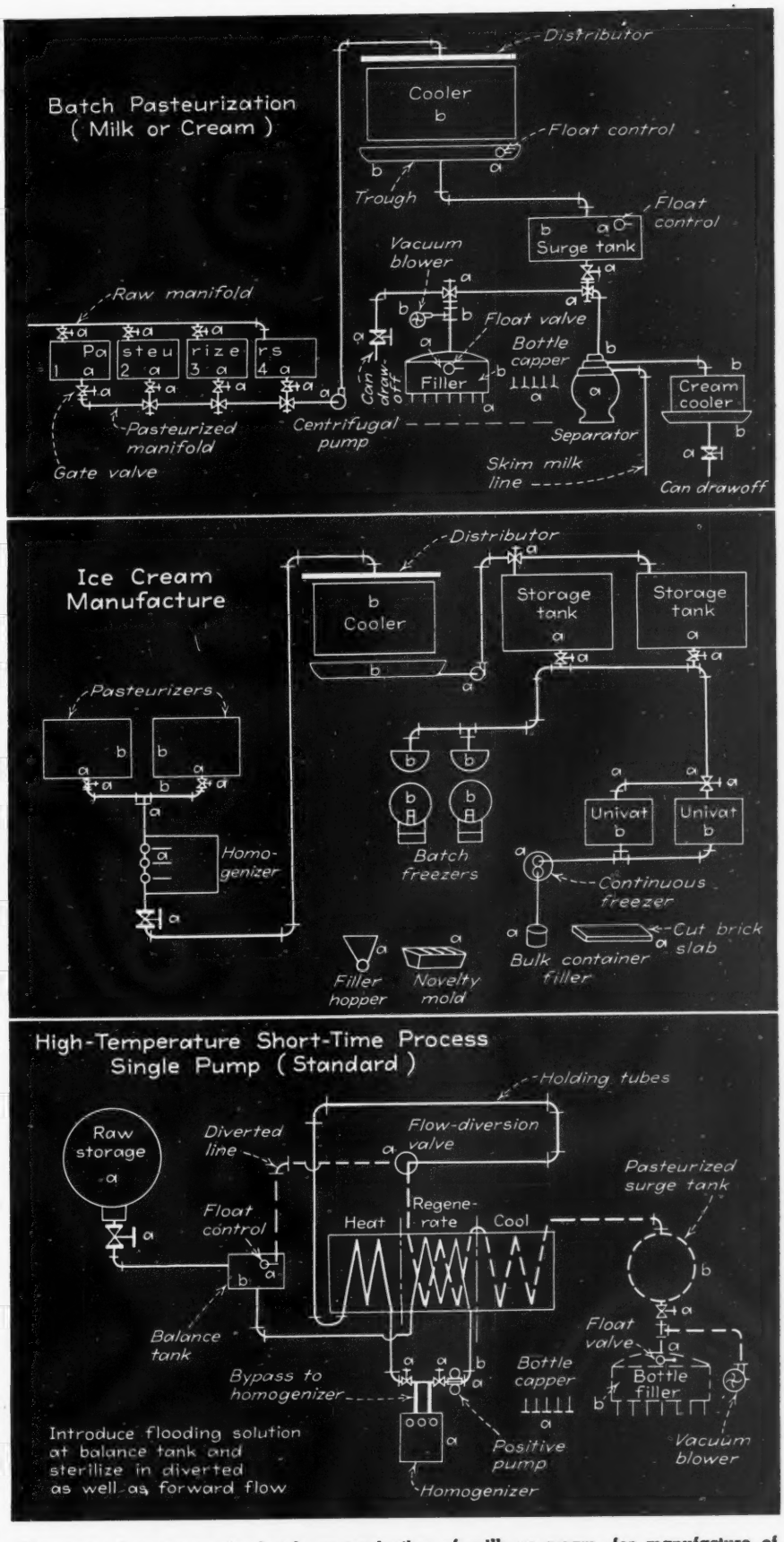
23. If clean equipment is heated to 150 deg. F. by hot water and held there for 10 minutes, coliforms will be destroyed. The water used should be well above 160 deg. F., so as to elevate

the temperature of all of the equipment to that point. Sufficient hot water must be used to maintain a full 160 deg. F. temperature on all surfaces for a full 10 minutes. Surfaces not contacted by the sterilizer in the direct course of solution flow (equipment covers, bottle cappers, and so forth) must be subjected to hot water independently. Hot-water sterilization takes too long if the system includes surge or storage tanks of large capacity. It is costly—especially under today's fuel conditions. The extreme expansion and contraction caused by such treatment will shorten the life of closely fitting parts. After the sterilization, the lowest points of the system are opened to drain the hot water out. Fittings (held in the hands) are immersed in a chemical sterilizer solution before they are put back.

24. Clean equipment is rendered coliform-free most conveniently by the use of chemical sterilizers. Of the chlorine compounds referred to in paragraph No. 7, sodium hypochlorite is the one most frequently employed in food plants. Health-department regulations generally require a "ten-minute contact by a solution containing 100 parts-per-million of available chlorine." Hypochlorite solutions are not stable; their available chlorine is lost gradually—more rapidly if acid waters are used in preparing them. The chlorine loss in any operation is determined by measuring the chlorine content (many simple tests are available) at the beginning and end. The amount of hypochlorite concentrate needed to provide 100 parts-per-million at the end will depend on the hypochlorite itself, on the operation and on the water employed.

25. If the equipment surfaces are truly clean, and "drain clear," all that is needed to sterilize with hypochlorite solutions of proper strength is the complete contact of all surfaces with the solution for the interval required. All small parts which can be completely immersed in a bucket filled with sterilizer solution, and assembled while immersed, are so treated. All ground-surfaced fittings are immersed. The seats for these fittings are sprayed heavily with the solution and the fittings inserted after both the seats and the fittings have received the required exposure to the solution. All surfaces of large containers and capper heads are sprayed heavily with the sterilizer. The small pieces are then installed and the system hooked up completely. Sufficient solution is now introduced at the pasteurizer gate to give all surfaces (except those of the large containers which have been sterilized by spray

(Turn to page 125)



Diagrams of processes for batch pasteurization of milk or cream, for manufacture of ice cream and for high-temperature, short-time pasteurization. The letters "a," "b" and "c" indicate the steps necessary in sterilizing the equipment, as follows: "a," immerse in sterilizing solution before or during assembly; "b," spray surfaces thoroughly; "c," (batch pasteurization of milk or cream) complete assembly, then flood, beginning at pasteurizer 1 (open gate valves to flood manifold sections completely). These diagrams provide a quick check on plant sanitation procedure.

Industry Needs Accurate Test For Vitamin A Enrichment

By H. W. VAHLTEICH and R. H. NEAL
Research Laboratories, The Best Foods, Inc., Bayonne, N. J.

Because of the quantities used, lack of concordant results from instrument and bioassays of vitamin A is critical. Fundamental scientific work is needed in order to improve the reproducibility of the bioassay technic

MARGARINE technologists are confronted with a problem peculiar to vitamin A as distinguished from several of the other vitamins such as B_1 and C. For vitamin A, the correlation of the instrument and the biological procedures for determination still leaves much to be desired, while for B_1 and C, accepted chemical or microbiological methods for quantitative assay are available. Yet the margarine manufacturer purchases his vitamin A concentrates on the basis of spectrophotometric determinations and must furnish a product of guaranteed potency on the basis of U. S. Pharmacopeia bioassay.

This article has a threefold purpose —to make clear the difficult position of the margarine technologist with regard to vitamin A enrichment, to point out the need for fundamental research on the technic of vitamin A determination, and to present a program for vitamin A enrichment of margarine which will be satisfactory in view of the limitations of testing technics currently available.

As a practical necessity in transactions involving large quantities of vitamin A, the industry supplying high-potency liver oils and concentrates or distillations of vitamin A-bearing oils in vegetable oil diluents accepts the spectrophotometric determination of this vitamin. The margarine technologist must guarantee to the user at least 9,000 U.S.P. units of vitamin A per pound of margarine—that is, the margarine must be found to carry this unitage, when bioassayed. But the bioassay is slow and at present does not give concordant results. The question then is, "Can the instrument-determined unitage be directly translated into U.S.P. units?"

This really involves two points: (a) The translation of the vitamin A potency of the enrichment oil determined instrumentally into the equivalent U.S.P. or biologically determined unitage, and (b) an instrument method for determining vitamin A in margarine. We shall deal here primarily with (a) and will soon publish separately an analytical procedure for the determination of vitamin A in margarine by means of the spectrophotometer.

Spectrophotometer Versus Bioassay Results

The extent of the difficulty can be judged from the figures in Table I. In this are recorded data on a number of high-potency vitamin A-bearing oils used over a period of years for enriching margarine.

In this table, the second column represents unitages of vitamin A determined spectrophotometrically in our own laboratories. In the industry, it is customary to report the potency as the extinction coefficient determined spectrophotometrically on a 1-cm. cell calculated to a 1 percent solution of the oil using a factor of 2000, or $E^{1\%}_{1\ cm.}$ times 2000. In our laboratory, using a Hilger Intermediate Model spectrophotometer, checks made many times over a period of years on the unsaponifiable matter of the U.S.P. reference oils have given an average factor of 2140, and it is this factor that is used in the table.

Bioassay results in this table are from three independently operated testing laboratories specializing in vitamin A assays.

The U.S.P. describes only single-level assays, from which it may be concluded that the oil under test contains not less than a certain unitage. The procedure provides for feeding two groups of animals (besides the negative control group), one group on the U.S.P. reference cod liver oil and one group on a stipulated amount of the oil under test. If, under the prescribed conditions, the average growth (weight gain) of the animals fed the oil under test equals or exceeds that of the animals on the reference cod liver oil, it may be concluded that the vitamin A unitage of the oil under test is not less than a unitage based on a prescribed calculation procedure. No provision is made for determining by how much the actual vitamin A potency exceeds the calculated figure.

However, a quantitative estimate of U.S.P. unitage can be obtained by an adaptation of the bioassay technic. This consists of feeding both the U.S.P. reference oil and the oil under test at two or more levels and then plotting the growth responses from both oils. When the logarithm of the weight gain is plotted against the weights (or doses) fed, a straight line is obtained. This is commonly referred to as a log-dose curve and provides the means for quantitatively determining

TABLE I—Tests on Vitamin A Oils.

Oil No.	Potency by spectrophotometer*	Potency by multiple-level bioassay, U. S. P. units per gram† Lab. A	Lab. B	Lab. C
119	473	342	470	....
70	511	....	550	....
61	133	160	110	....
91	185	155	158	....
32	179	151	148	....
52	386	275	355	....
82	132	64	125	72
112	420	308	272	....
33a	201	145	158	....
33b	201	195	146	....
		197		
53	212	208	140	....
23s	210	154	124	....

* Extinction coefficient determined spectrophotometrically (Hilger, Intermediate Model) in a 1-cm. cell on a 1 percent solution of the oil in cyclohexane (especially purified) or or E 1% /1cm times 2140.

(The factor 2140 is an average for our laboratories, checked many times over a period of years on our own instruments on the unsaponifiable matter of the U. S. P. Reference oils (I at 3000 and II at 1700 units per gram.)

TABLE II—Bioassay Results.
(U. S. P. units of vitamin A per gram on Oil No. 82 of Table I, based on log-dose interpolations from feedings at two or more levels.)

Laboratory	As oil	As margarine
A	64,000	125,000
B	125,000	
C	72,000	

the biological activity of the vitamin A-bearing oils. The number of animals involved is quite large, so that considerable time may be necessary for assembling the several groups required. Hence, while a single-level U.S.P. bioassay for vitamin A would require a minimum of about four weeks, the more comprehensive and quantitative procedure usually requires considerable additional time.

Changing the Factor Will Not Give Agreement

It is noteworthy that the instrument and biological results do not agree in most instances. In fact, in only a few instances does the average of the bioassays come reasonably close to that of the instrument results. This could be partially rectified by reducing the factor used in arriving at the instrument unitages. There has been much discussion in the trade in recent years about this factor, and the current practice in buying and selling vitamin A-bearing oils in the U. S. is to use the figure 2000. If in Table I all the results for Laboratory A be *averaged* and compared with the instrument results, it is found that if 1560 had been used as an instrument factor, the *average* instrument results would have about equaled the *average* of Laboratory A's results. Similarly, if 1820 had been used as an instrument factor the *average* instrument results would have about equaled the average of Laboratory B's results. From this, one might draw two conclusions: (1) That the factor 2000 is too favorable to the seller and (2) that the British practice of using a factor of about 1600 is more equitable in relation to bioassay results. It is to be remembered, however, that the real problem is not one of striking averages, but of arriving at the vitamin A potency of a sample of enriching oil.

The difficulty lies in the apparent inability to obtain reproducible results from the bioassay laboratories.

Bioassay Results not Reproducible

In one case, that of oil No. 82, Laboratory B reported about twice the potency found by Laboratory A. Margarine enriched with the oil No. 82, for which a potency of 64,000 units per gram was reported by Laboratory A, was submitted to this laboratory. The margarine was fed at two levels and the reference oil also at two levels. Log-dose curves indicated a potency of 125,000 units per gram of vitamin A in the oil used. At the same time, the oil itself was submitted to a third experienced biological testing laboratory with the request that it be fed at levels of 70,000, 100,000 and 130,000 units per gram and that the reference oil be fed at two levels. All four sets of results are summarized in Table II.

A laboratory worker feeding one of a group of rats used in a bioassay of vitamin A. At present the standard test method requires at least 30 days, and does not yield reproducible results in spite of careful and detailed records and procedures.

This demonstrates the possible variations in results and indicates the lack of reproducibility of the bioassay technic as it is available to the margarine technologist. This reproducibility is normally within a narrower range than in this particular case, as evidenced by the data presented in Table I, and it may be within a narrower range in a single laboratory than between two or more bioassay laboratories. However, the margarine technologist must assume that the finished product will probably be tested by another laboratory than the one which passed on the vitamin A-bearing oil used, so that at least two bioassay laboratories should pass on the potency of the enriching oil.

The frequent disparity in results on a given vitamin A-bearing oil between two or more experienced and well-operated laboratories is hardly to be regarded as novel or unexpected. Over 1600 rats were used by 14 different laboratories in arriving at the unitage (set at 1700 units per gram) of the current U.S.P. reference cod liver oil, and apparent variations in potency from 1000 to 2500 units per gram were reported.[1] An excellent recent review of this situation is that by Hickman.[2] In view of the data available, we agree with Hickman in suggesting, as far as the bioassay is concerned, that the first requirement is study of a number of fundamentals for the improvement thereof and elimination of variations rather than that huge cooperative bioassays continue to be considered as a solution. These latter would arrive only at averages and would not serve to solve the problem in hand.

Program Suggested

Since the U.S.P. bioassay for vitamin A is the only one legal in this country and since trade practice in the purchase and sale of large quantities of vitamin A is to estimate the potency at 2000 times the $E^{1\%}_{1\,cm.}$ value in units per gram (with suitable reservations), the margarine technologist is in the position of receiving vitamin A supplies on one basis and dispensing them on another. His guarantee to the consumer must be in terms of U.S.P. units. His responsibility to his employer includes a guarantee against waste. We feel that the facts call for a program along the following lines:

1. Purchase of vitamin A must be made six months to two years in advance of final use because:

a. Six months to a year must be allowed after receipt and before use in margarine so that there is time for adequate bioassays to establish a range of potency.

b. Large enough quantities of vitamin A must be purchased at one time and out of one pot, so-to-speak, to justify the expense of adequate bioassays.

2. The vitamin A-bearing oil should be submitted to at least two competent independent laboratories, to be fed by each laboratory at two levels in the same ratio.

TABLE III—Tests on Finished Margarines.

Oil used	From spectrophotometer determinations: Expected potency	From spectrophotometer determinations: Actual potency	Multiple-level bioassay results (by log-dose curve interpolation): Potency calculated from tests on oil by: Lab. A	Potency calculated from tests on oil by: Lab. B	Actual potency determined by: Lab. A
61	16,000	16,700	19,200	13,100	11,800
32	16,700	16,900	14,100	13,600	12,300
32	13,300	13,800	11,200	11,000	13,100
32+52	16,600	17,100	13,400	13,700	14,200
32+52	16,600	16,500	13,400	13,700	18,800
32+52	16,600	16,300	13,400	13,700	19,300
32+52	16,600	16,500	13,400	13,700	16,400

For the U.S.P. reference cod liver oil we have used a 3 to 5 ratio because this gives fairly widely separated points on the curves and because feeding 1½ and 2½ units of reference cod liver oil gives growth rates in a reasonable range. Smaller or larger unitages of reference cod liver oil too often result in growth outside the 12- to 60-gm. range specified by the U.S.P. Thus if an oil gives spectrophotometric data indicating a unitage of 200,000 units per gram, it should be fed at levels of 150,000 and 250,000 or at 120,000 and 200,000 units per gram.

Also, the spectrophotometric absorption curve for the oil should show no abnormalities and there must be no significant drop in vitamin A potency in 18 to 24 months when stored at 25 to 30 deg. F. or lower.

From the animal-feeding data, log-dose curves are to be plotted to arrive at the approximate potency of the enriching oil.

3. It is essential to include a large excess of vitamin A in the margarine over and above the label requirement (9000 units per pound). This excess should be at least 50 percent above the arithmetic average of the log-dose estimated potencies reported by two or more bioassay laboratories. This would mean adding a minimum of 13,500 units per pound, based on an average vitamin A potency of the enriching oil as obtained from the bioassay log-dose curves from results of at least two bioassay laboratories.

Since it is not generally appreciated that the bioassay procedure for vitamin A is incapable of a reproducibility comparable to that of other commonly used vitamin-testing procedures, it is only natural that such a policy should lead to considerable discussion. Occasionally, spectrophotometric results indicating potencies of over 20,000 units per pound of margarine (probably often true) will appear on the daily control-test records and stimulate inquiry from manufacturing and other departments within the organization as well as from government inspection officials.

Also, since several state governments have recently decided to exercise some degree of control over vitamin additions to foods (including vitamin A in margarine) by various optical methods, quite a range of instrument results is to be expected. Our own laboratory group has now in preparation an optical method for the determination of vitamin A in margarine which has been found to give results in reasonable agreement with U.S.P. bioassay results.

Instrument Results Are Reproducible

Here again, it becomes important to point out that disparities between instrument results and bioassay results in individual cases are no reflection on the suggested instrument technic, because wide variations in bioassay results are normal. Instrument results should only be compared with the average of a considerable number of bio results in arriving at an appraisal of an instrument procedure.

Fundamentally, the situation is (a) that there are two methods, one of which is reproducible to plus or minus 5 percent or better (instrument) while the other is not normally capable of reproducibility to much better than plus or minus 25 percent (bio); and (b) that at the present time the method normally capable of only about plus or minus 25 percent reproducibility be the only legal method.

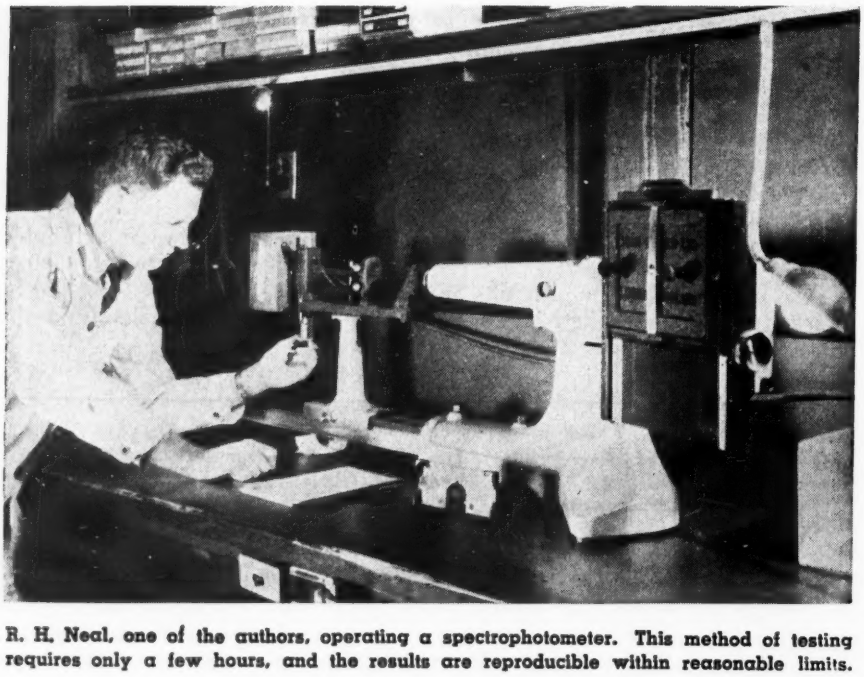
Since one who buys vitamin A really buys an expected biological effect, he has a right to expect a biological assay by the seller or vendor. The fact that in such a bioassay he finds a disappointing reproducibility for his purposes should possibly stimulate the biochemists responsible for the assay to produce a better assay, but until that occurs the lack of reproducibility of the assay technic will have to be faced. Judging from published progress in this direction during the past 5 to 10 years, there would seem to be little hope for immediate improvement. Hence, the margarine technologist is faced with the practical necessity of overcoming the lack of reproducibility of an official method to a reasonable degree, which results in this suggestion that 50 percent excess of a vitamin A-bearing oil be used on the basis of an average biologically determined potency established as described above.

Proposed Excess Will Meet Specifications

By way of illustration, typical variations can readily be calculated from the tabulated data. Let us consider oil No. 82 as representative of the widest range of variation between biological and instrument results, and oil No. 61 as representative of the narrowest range. The average of the bioassays on oil No. 82 is practically 87,000 units per gram, while that of the bioassays on oil No. 61 is practically 135,000 units per gram. The latter is nearly identical with the instrument result of 133,000 units per gram. Hence, oil No. 61, when used in 50 percent excess of the amount indicated by the 135,000 units per gram, will give instrument results approximating 13,500 to 14,000 units per pound of margarine. However, if Laboratory B tested this margarine by the U.S.P. bioassay technic and obtained results consistent with the results previously reported for the oil, the vitamin A potency of the margarine should approximate $(110/125) \times 13{,}500 = 11{,}000$ units per pound. Similarly, Laboratory A should find a potency of 16,000 units per pound.

Oil No. 82, when used in 50 percent excess based on the value of 87,000 units per gram, will give instrument results of $(132/87) \times 13{,}500 = 20{,}500$ units per pound on margarine. Assuming again that Laboratory A tested this margarine and obtained biologically determined results consistent with its results previously reported for the enriching oil, the vitamin A potency for the

(Turn to page 136)



R. H. Neal, one of the authors, operating a spectrophotometer. This method of testing requires only a few hours, and the results are reproducible within reasonable limits.

EDITORIALS

LAURENCE V. BURTON, Editor

Our New System Of Page Numbering

A new system of numbering our pages was introduced into FOOD INDUSTRIES with the February number. The innovation was made in response to many requests from librarians and researchers who were looking for a simpler method of citing references to our pages. To accommodate their needs, there is now a double system of pagination. The old one with which most readers are familiar is continued—numbering pages by issues. The new method is called "volume page" numbering and consists of placing serial page numbers on all pages in a volume on which there appears any editorial text matter, irrespective of the presence or absence of advertisements. Those who wish to cite references to these pages will find the volume pagination more convenient.

Give to the Red Cross

There are calls aplenty for money nowadays, but none is more deserving of everybody's donations than the Red Cross. Old timers who were in the first World War realize the current absence of acrimonious remarks about service organizations. Red Cross is doing a good job. Pay your taxes, buy War Bonds, but also give to the Red Cross.

Packaging Conference

Emphasis on protective packaging in the food processing industries reaches a climax each year at the time of the Packaging Conference of the American Management Association. This year the conference is to be held in Chicago at the Palmer House, March 28-31. Keep in mind that there is also a Packaging Exposition to which admission is gained by registration without fee. Admission to the meetings, where technical discussions of packaging are held, costs a moderate fee.

Under today's stress and shortages of all sorts of packaging materials, these meetings are well worth your time, money and attention.

Prospects for Equipment

Events will soon be moving very fast. Some items of military equipment are in such generous supply that cut-backs have been ordered on their production. Others, such as airplanes, trucks, tires, landing craft and a few other expendibles are likely to be in continued demand until the war is over. But, in the words of persons who control the war production of the United States, aluminum and magnesium "are running out our ears," alloy steels are fairly easy; copper?—yes, we are building up a stockpile; carbon steel?—easy in some fields, tight in others; sheet steel?—very tight; lead and zinc?—plenty. In short, we are fairly well fixed for all metals but are very short of lumber and paper.

In view of this summation, the industry asks: Why cannot limited production for civilian use be resumed?

Our own opinion is that there is nothing in the raw-material situation to prevent it except reasonable military caution. It is our further belief that, after the invasion takes place and our European bridgeheads are firmly held and greatly enlarged so that there is no further need to hold all munition plants in readiness to resume full-scale production, you will see a moderate relaxation on the use of metals for many civilian purposes.

It appears likely that some restrictions will be lifted, even before the surrender of Germany. As nearly as we can ascertain Washington thinking, the idea is to permit then the manufacturing of limited amounts of essential civilian items, as well as more repair parts, spares and a moderate amount of new industrial equipment to replace that which is worn out. It won't be a full resumption of peacetime activities, but likely it will require less effort to get the priorities for needed equipment.

Inexplicable Contaminations

A strange and mystifying case of contamination of frozen cherries with phenol (carbolic acid) reveals the need for more intelligent supervision of workers, war or no war. For regardless of food shortages there is no market for cherries that taste strongly of carbolic acid. For identification purposes a manufacturer had had the can lids rubber stamped with a phenol-containing ink, the purpose of the phenol being to make the ink adhere strongly to the tinplate. Then the lids were stacked to dry. The ink "offset" from the top or outside of one lid to the bottom or inner side of the next one in the stack.

The foregoing incident parallels in method the presence of cigarette butts and a dead mouse in the top of a fresh 2½-gal. can of ice cream in a soda fountain. It just could not happen in the factory, but there it was. Long investigation revealed that frost on the bottom of a can set on the floor back of the fountain picked up the stuff from the dirty floor. Then when replaced in the cabinet, atop another can, the filth was deposited on the ice cream just underneath, and pushed below the surface.

Both incidents were difficult to explain but there is always a commonsense explanation for such matters. Constant careful supervision is always necessary.

New Dried Egg Specifications

The long awaited new QMC specifications for dried eggs issued on Jan. 28, 1944 (C.Q.D. No. 117A superseding C.Q.D. No. 117, 4 March, 1943) call for 2.0 percent of moisture.

As recently as a few months ago, the egg drying industry felt that dehydration down to 2 percent moisture content was impracticable; even practically impossible.

The keystone of successful dehydration to 2 percent is a preheating

or possibly what might be termed a pasteurizing treatment, of the eggs immediately preceding drying. Preheating has been attempted in the past but with unsuccessful results, because the eggs were not kept at a definite temperature between the time they were preheated and sprayed through the drying chamber.

Indications from results obtained in an experimental way are that before the war is over and a serious attempt is made to market these dried whole eggs for home use, the residual moisture content will be reduced to somewhere between 0 and 1.0 percent. Experimentally, those results are being obtained. The big question is at what cost can that low moisture content be obtained commercially.

Missouri Town Becomes Cash-corn Market Center

A differential of 3½ cents per bushel in the OPA ceiling price temporarily diverted cash corn from the usual markets to Monett, Mo., for the first two weeks in January. Crane, Mo., next held that fleeting honor, attaining it by being officially designated by OPA as "deficit area"—short of corn.

While the ceiling price for corn in Monett and the successor deficit areas was $1.19½ per bushel as compared with $1.16 in Chicago or Peoria, some towns in southwestern Missouri had a price advantage of as much as 5 cents per bushel, and many California points were favored by as much as 4½ cents. These differentials resulted from OPA regulations setting erroneously high ceilings for those areas.

While Monett, Mo., and similarly favored markets were being flooded with 5 to 10 million bushels of corn from Iowa and Nebraska, Chicago brokers were unable to obtain sufficient corn to supply their customers.

OPA claims the sales to be illegal on the basis that most of the corn was not delivered to these points but merely routed through them so sellers could claim technical delivery and take advantage of the high ceiling prices. Amendments to the regulations are promised to prevent a continuation of heavy purchases at those points.

For Those Who Look Ahead

Research programs in the field of nutritive properties of industrially prepared foods have been largely centered around the presence or absence of vitamins. This is sound strategy, for it is necessary to know the selling points and vulnerable points about a firm's production. Given a few more years, all large producers will have their own vitamin story pretty well settled.

Then what?

Amino acids are now coming in for study, especially during the protein-shortage era. Research in this field will be slow and expensive until new technics are discovered. But it is foreseeable that in another decade or so the amino acid story of most commercial food production will be known.

Will this mark the end of industrial nutritional research in food companies? It seems not, for there are at least two more major fields—mineral salts and essential fatty acids—still to be explored, both for defensive and for aggressive merchandising.

Any company heads who are undecided about the strategy of nutritional research programs can be assured that there still is at least 20 years of work ahead. And when that work is finished, there doubtless will be other new factors to be studied.

This form of research is on the "must" list for commercial defense, if for no other aggressive reason. With the world becoming acutely nutrition conscious, one dare not leave the reputation of his own lines open to competitive attack.

Business Men Have Thin Skins

Most of OPA's troubles arise from the unbusinesslike type of organization which the present Administration has set up among the various wartime agencies. OPA has many functions—few real responsibilities. It rations whatever some other agency tells it to ration, without regard to any other matter. It also is supposed to "hold the line" on prices without regard to any other problem arising from its execution of orders. Its ceiling-price function is another job.

Chester Bowles has his orders and, like it or not, he is trying to do as he is ordered—a job that is well-nigh impossible. Just why he or any of his more capable subordinates are willing to keep on trying apparently involves a spiritual call to higher duty that is beyond average comprehension. A secondary problem is the thin skins of many business men who, lacking any previous schooling in rough-and-tumble politics, are grievously-hurt when a member of Congress calls an OPA executive a liar or an imposter. The business man, never having had to face an unjust charge before, grows angry and chucks the job without realizing that the average member of Congress is talking for the newspapers and the folks back home. Anyone with a wide acquaintance in Congress can testify to the lack of superlative qualities of most of the men who are elected to make our laws. They do, however, possess one characteristic in common. They are all scrappers, can take it as well as dish it out—which is where the business man is usually weak. He is usually at an unbearable disadvantage in a name-calling contest, and the Congressman enjoys legal immunity for his verbal accusations.

Unless OPA's place and function in the super-duper wartime setup is changed, a rhinocerous hide is an indispensible attribute to the higher jobs. The allotted task of OPA is so inconsistent with common sense that no one on Capitol Hill will ever be satisfied with OPA's acts, however well they are performed.

Get Out of Debt

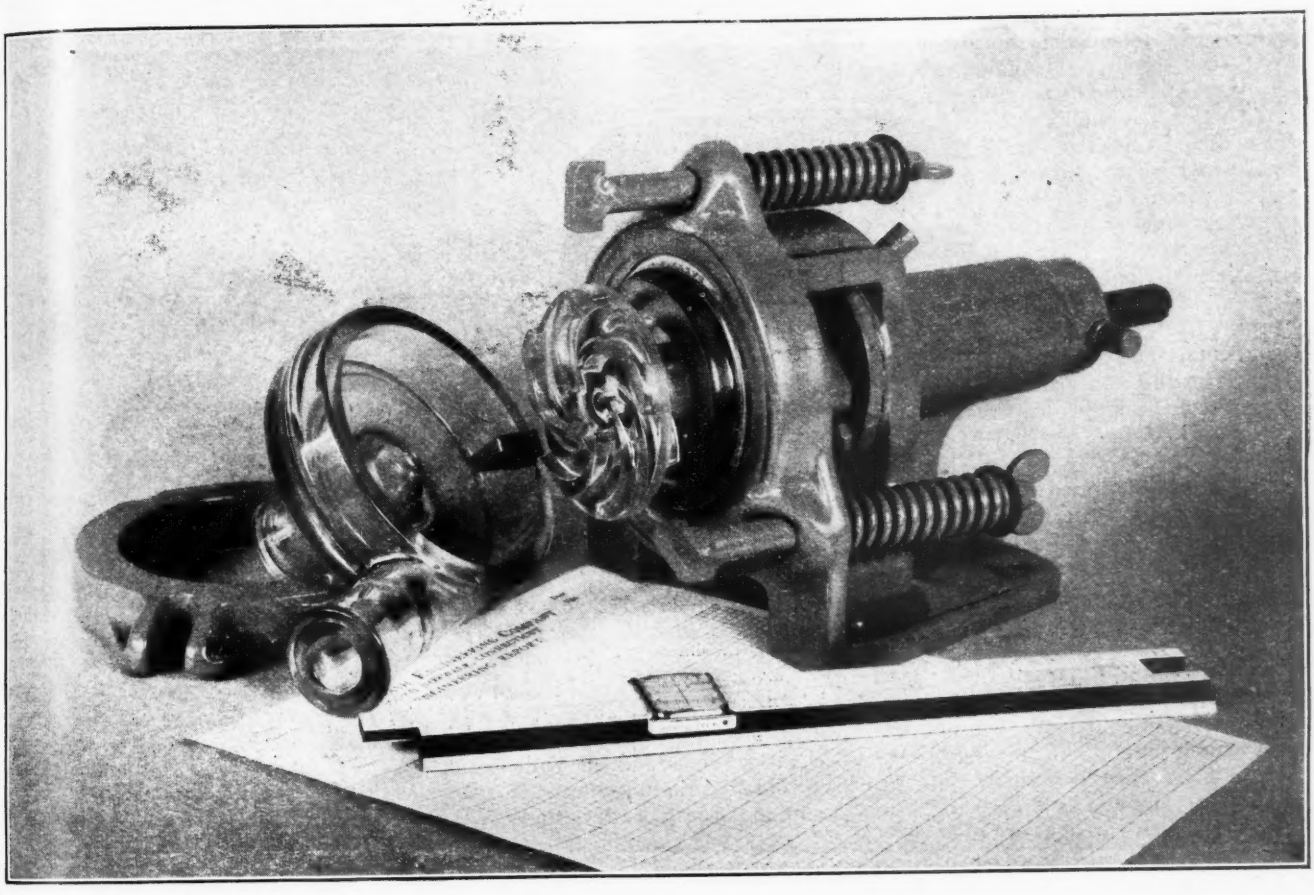
As far as can be learned there is only one advantage to a period of inflation:

It is theoretically possible for everybody to get out of debt.

If price controls do not hold and the runway occurs, the opportunity will come—once—to cast off the shackles to the past.

Don't forget the disasters that overtook those who were in debt during the last depression. To owe no man is to be a free man, able to adapt oneself to what may come with a minimum of grief.

Made of "PYREX" Brand glass, and no longer than a slide rule, this pump handles 600 gallons an hour



Ideal for small capacity installations, laboratory and pilot plant operation, this little brother of our big Nash Centrifugal Pumps of "PYREX" Brand glass nicely handles 10 gallons of liquid per minute with the assurance that the material pumped will not be contaminated by contact with the pump structure.

Whether your process involves hot solutions, brine cooled liquids, or fussy products you want to protect from an "off" flavor, this pump is equally reliable and will render twenty-four hour service without too much watching.

All working parts of this pump, including impeller and casing, are constructed entirely of clean, sparkling "PYREX" Brand glass. The pump is fully transparent, and permits constant inspection of liquid being handled, for color, condition, etc. If the pump needs cleaning it is immediately made visible, and it can be opened, cleaned and reassembled in a comparatively short time.

A unique mechanical seal replaces the conventional stuffing box, and a safety unloading device eliminates possibility of fracture of the glass casing should the pump be accidentally subjected to excessive pressure. An iron housing protects the glass structure from external shock. With due consideration for the fact that it is glass, you will find this a durable piece of equipment.

Write for Bulletin No. 336, which describes this sensational pump in detail. If interested in larger capacity Nash Centrifugal Pumps of "PYREX", ask also for Bulletin 313.

NASH ENGINEERING COMPANY

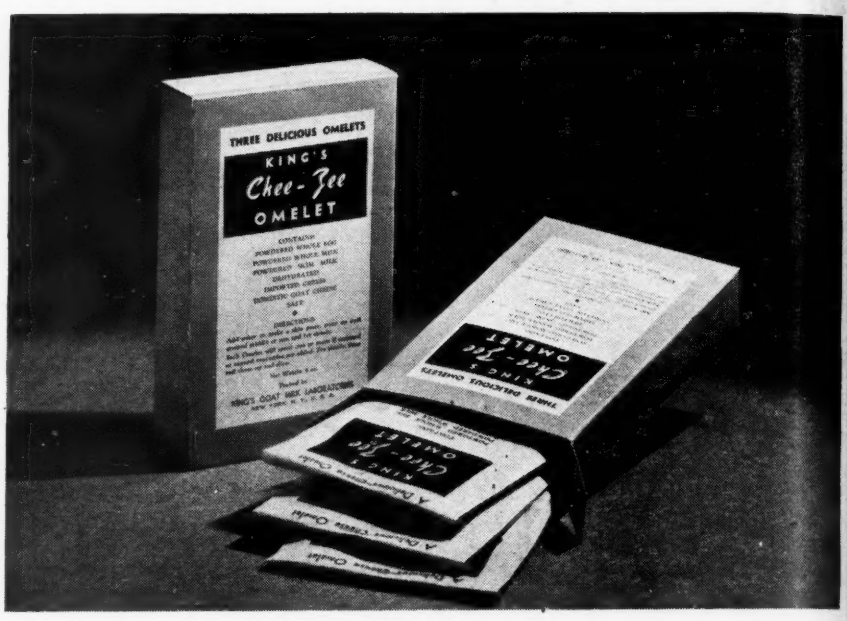
267-A WILSON ROAD, SOUTH NORWALK, CONNECTICUT

NEW PACKAGES & PRODUCTS

Dehydrated Omelet

"CHEE-ZEE OMELET" is another new product to be added to the list of dehydrated foods. Manufactured by King's Goat Milk Laboratories, New York, and nationally distributed, the dehydrated cheese omelet contains powdered whole eggs and milk, powdered skim milk, dehydrated imported cheese, domestic goat cheese and salt. It is packed in 1-oz. heavily waxed glassine envelopes, the tops of which are folded and stapled. There are three, 1-oz. packages in a cardboard container. The glassine envelopes are placed in the cardboard box not only to protect the individual packages but to make a more convenient selling unit.

Each omelet serves two or more people if steamed or canned vegetables are added and the product fried slowly, rolled and sliced.



Vitamins in Coffee

COFFEE CORP. OF AMERICA, Chicago, is the manufacturer of a vitamin-fortified coffee, "Blend 150." On and off the market because of coffee rationing, since it was first introduced late in 1942, this product is now being distributed largely throughout the Middle West, but also in Pennsylvania, New York, Kentucky, Tennessee and Florida.

Six varieties of coffee have been combined to make up this blend—Medellin from Colombia, for richness, Mexican Coatepec to give a winey flavor, Guatemala for mellowness, San Salvador for full body, Costa Rica for fragrance and Arabian Mocha to add distinctive flavor. Blend 150 contains over 1,200 International Units of vitamin B_1 per pound of coffee. It is packed in 1-lb. wax-lined white pique bags folded at the top, or in 1-lb. glass jars in all-purpose or drip grinds.

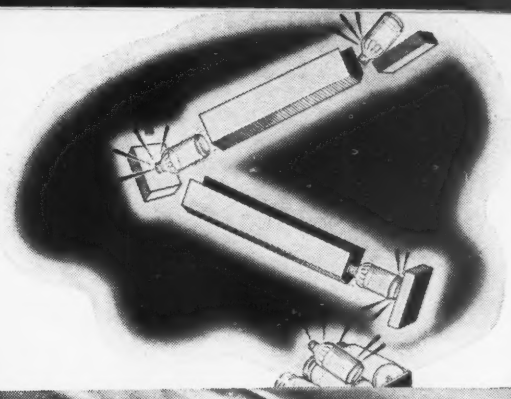
Rum Soakies

PREPARED from specially baked fruitcake so that they will retain their shape after the soaking process, "Rum Soakies," fruitcake fingers in a rum sauce, have been manufactured by Burry Biscuit Corp., Elizabeth, N. J. Made from fruit peels, raisins, cherries, whole eggs, salt, butter, sugar, pecans, shortening, flour, selected spices, corn sirup, brandy, choice molasses, dextrose rum and artificial flavoring, these finger-shaped desserts can be served with ice cream or used as cake.

The fruit cake is first baked in large slabs or sheets and then cut down into the finger size, which is about $1\frac{3}{4}$- by $\frac{3}{4}$-in. The rum sauce is poured over the soakies after they have been put into 1-lb. glass jars, approximately 22 to a jar, and closed with enameled metal screw caps which have waxed coated chipboard liners.

"COMMANDO COURSE" FOR BOTTLES

Tests like this are part of research's constant efforts to make better glass



GLASS research isn't all chemical equations and mathematical formulae. Armstrong's research men devote considerable time to physical testing of our product. Many of the tests are in addition to the usual procedure and are hard-boiled, practical affairs that subject the glass to more severe conditions than they would be subjected to in actual use.

For example, when Armstrong's Laboratories wanted some additional data on the mechanical strength of certain bottles, they built what could be called a "Commando Course" for bottles. Starting at the top of this structure, the bottle first dropped a foot and banged its shoulder against a hard block.

Then it raced four feet down a steeply inclined chute and smacked its finish against another hard block. Four feet down another chute, it bounced its bottom against a block, dropped a foot, and rolled on its sides three feet down an inclined "washboard" made of bottles. After each "run," the bottle was given a thermal shock by immersion, first in hot and then in cold water.

There weren't many unanswered questions about the ability of Armstrong's Bottles to "take it" after each one had been subjected time and again to this gruelling ordeal!

Practical, thorough tests like this are typical of the research constantly being conducted by Armstrong's chemists, physicists, and engineers. Their active interest in the practical as well as the theoretical aspects of glass production is one of the big reasons why Armstrong's Glass has been, and will continue to be, top quality.

Further interesting facts about the patience, skill, and experience devoted to the making of fine glass are presented in Armstrong's booklet, "Men and Glass." For your free copy, write Armstrong Cork Company, Glass and Closure Division, 4203 Prince St., Lancaster, Pennsylvania.

ARMSTRONG'S GLASS

and **ARMSTRONG'S CLOSURES**

WHICH CAP WILL CUSTOMERS REMEMBER

CUSTOMERS remember *any* cap when it carries a colorful trade-mark or other distinctive design. For then, every time they use the package, the brand is fixed more firmly in their minds.

That's why it pays you to put your identity or sales message on caps . . . especially if you're packing a line of allied products. Properly used, this advertising space can build brand recognition for your whole line, make your package stand out in display, encourage customers who are familiar with some of your products to try more of them.

Making proper use of the advertising space on Armstrong's Metal Caps is a specialty with us. Why not let us show you how we can translate your name or trade-mark into a sales-building cap design? Just drop a note, and a sample of your package to Armstrong Cork Company, Glass and Closure Division, 4303 Prince Street, Lancaster, Pennsylvania.

Armstrong's Closures

TURN STANDARD CONTAINERS INTO STANDOUT PACKAGES

Rice Dinner

WYLER & Co., Chicago, has packaged a victory meal called Rice Dinner. This cellophane-wrapped product weighs 4 oz. and may be used either as

a complete dinner by itself or for soup. It is prepared merely by heating water, tomatoes and a small amount of butter and adding the entire package of rice dinner. Rice, salt, dehydrated onions, tomatoes, garlic, grated cheese, dextrose and spices are the ingredients which go into the processing of the product.

New Army Products

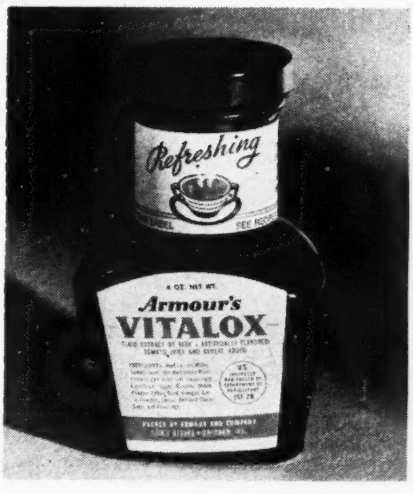
A SPECIAL hospital ration and a bread stabilizer have recently been developed by the U. S. Quartermaster Corps. The hospital ration, consisting of several readily assimilated foods, is sufficient for 25 men for one day, and is used in field hospitals overseas. It includes canned fruits such as apricots, peaches, pineapple or fruit cocktail, orange and grapefruit juice or a blend of these, dehydrated soup, coffee, sugar and evaporated milk. Each food is packed in metal containers, and the entire ration placed in a wooden box marked with the Red Cross insignia. The ration weighs about 60 pounds, and is fairly easy to transport even to hospitals in the fighting zones. The hospital ration is intended to supplement the standard field rations with larger quantities of soft foods and luxury items necessary to the diet of hospitalized soldiers.

The bread stabilizer is a simple mixture of edible chemicals derived from ammonia. It improves the quality of bread made with active dry yeast, both fresh and at different stages of deterioration. The stabilizer shortens the required fermentation time in bread making, especially when the yeast has lost some of its strength through prolonged storage or storage at high temperatures, and helps eliminate the waste of bread caused by mold. By shortening the fermentation time, a larger quantity of good-quality bread can be produced per unit of time with the same equipment and the same number of men.

The stabilizer is expected to be of value to troops operating in warm humid climates, since yeast deteriorates more rapidly and the mold is more acute when temperatures and humidity are comparatively high. Relatively small quantities of the stabilizer are required. Only 12 oz. to 100 lb. of flour is necessary to produce the desired results.

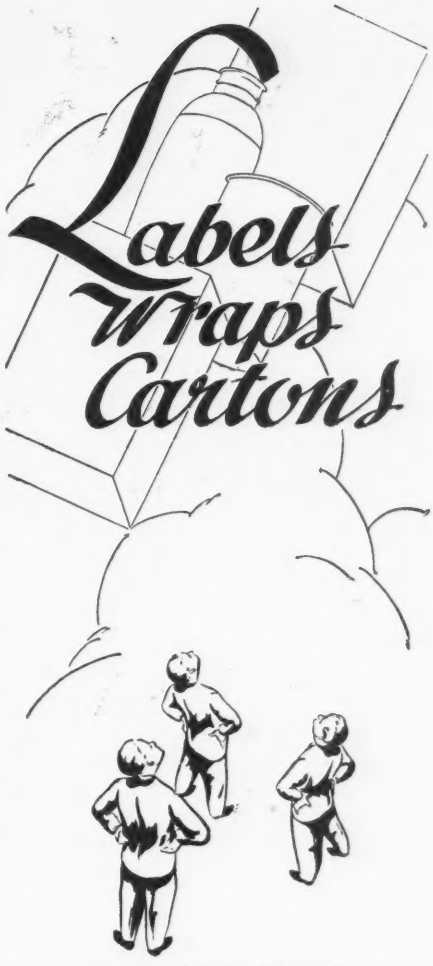
Meat Flavor

"VITALOX," the new meat flavor developed by Armour & Co., Chicago, lends seasoning, flavor and color to soups, gravies and stews, and is a foundation broth for hot and jellied soups,



without the addition of meat stock. A blend of beef extract, water, tomato juice, salt, hydrolized plant protein, cornstarch, sugar, glucose, refined corn sugar, seasonings, spices and flavorings, Vitalox adds meat flavor without points and at a low cost. It is a dark brown viscous liquid which pours easily and mixes quickly with either hot or cold water.

Although found in a 4-oz. bottle on the grocers' shelves for consumer use, the 1-lb. bottle is the most economical and convenient size for hotels, restaurants and other institutions. The small size has an enameled metal cap with lugs which engage glass threads when the cap is turned. The cap is lined with a paperboard disk.



LOOKING AHEAD...

No merchandiser is fooled by the ease with which his product sells nowadays. Abnormal conditions are always temporary. That tough Buyer's Market may be just around the corner.

Buying habits are being formed today as always. Mrs. Consumer, whether consciously or unconsciously, continues to make a bee-line for Quality—and Quality is unmistakably typified by a distinctive, appetite-whetting package.

The Rossotti organization offers you a completely integrated service on fine Labels, Package Wraps and Folding Cartons—from sketch to finished product. Complete Art, Idea, and Merchandising Counsel.

Why not call in a Rossotti Packaging Man for a constructive discussion of your individual requirements? Or drop us a line at our North Bergen Plant. No obligation at any time.

ROSSOTTI LITHOGRAPHING COMPANY, INC.
NORTH BERGEN, NEW JERSEY

West Coast Division
Rossotti West Coast Lithographing Corporation
San Francisco, Cal.

Sales Representatives in Principal Cities

Even under fire our soldiers

get their daily quart of milk!

Wherever our fighting men go, their K ration kits supply them with their daily milk supply . . . in the form of cheese packed in 4 ounce cans!

It takes 10 pounds of milk (5 quarts) to make one pound of American Cheddar Cheese . . . so each of these 4 ounce cans contains the essential food values of a quart plus an additional glass of milk.

The Plymouth, Wisconsin, Plant of the Lakeshire-Marty Co., Division of The Borden Company, packs millions of pounds of Pasteurized Processed Cheese in sturdy, easy-to-open cans supplied by Crown. In all parts of the world, our fighting forces are getting their "quart of milk each day" . . . in the form of cheese . . . thanks to these Crown Cans that protect the contents from the Wisconsin plant all the way to the front!

One more reason why the men and women of Crown take extra pride in their job of making the containers that serve our fighting men!

CROWN CAN COMPANY, New York • Philadelphia
Division of Crown Cork and Seal Company, Baltimore, Md.

★ ★ ★

CROWN CAN

FOOD INDUSTRY NEWS

Food Processors Given 1944 Program At Chicago

Modified formula pricing adopted by government to be based upon study of 1940-41 costs and profits

THAT civilian consumers will receive fewer cans of fruits and vegetables in 1944 became apparent when the government announced its set-aside percentages at the Food Processors Conference held in Chicago last month. Approximately two-thirds of all canned fruits and vegetables will be held for government buying agencies. The percentages are to range from 26 to 150 percent, the latter being for canned carrots, which replaces an equivalent amount of dehydrated carrots, now in heavy inventory.

Skeptics first thought that the high percentage of set-aside was due to the Army's replacement of dehydrated vegetables with the canned variety, but the next day they were confounded by evidence of the continued government need for full production of dehydrated vegetables with the exception of carrots.

While the freezing industry will continue on a capacity basis, the lack of sufficient storage and distribution facilities precludes any notable expansion to compensate for the smaller quantities of canned foods allowed for civilians.

Jean F. Carroll, director of the Food Price Division of OPA, presented a pricing program which was designed to encourage maximum production of canned fruits and vegetables. A modified formula plan was favored except for the citrus products pack, which remains on a flat price basis.

The modified pricing formula was adopted to adjust the base period prices and to give the industry a profit in the range of 7½ to 8½ percent, while maintaining the customary competitive relationships between firms, products and grades. The Agricultural Marketing Administration's grading will be used, but in no sense is this a move toward or endorsement of "grade" labeling.

The actual profit percentage to be adopted depends upon the results of the study now being made of industry costs and profits during 1940 and 1941. These years were chosen instead of 1936-39 because they more accurately represent "normal" years for the canning industry.

The 1944 prices will be arrived at by adding the increases in cost of the raw materials, labor supplies and other cost factors to the average 1941 cost. To this base will be added the profit which is to be determined through a study of the 1940-41 profits.

There will be no "borrowed" prices in the 1944 program. Canners who have begun operations since 1941 or who have introduced new products or new container sizes will be assigned prices from the Washington OPA office. These prices will be at or near the bottom of the range for the commodity and grade represented.

It was emphasized that the new method is not a plan to control profits, since the prices are to include both costs and profits.

Program for Freezers

The frozen food industry was told that it had not as yet been included in WFA's support-price program, although the 1944 requirements for the armed forces amounts to 50,000,000 lb. of green peas, snap beans, corn, lima beans and spinach. All freezers of more than 200,000-lb. capacity were requested to set aside an amount not to exceed 24 percent of maximum production.

Preservers' Picture

The preservers will be included in the support-price program as soon as the WFA price and profit study is completed. While 1944 production requirements are not as yet determined, they are expected to be about the same as in 1943, or 647,000,000 lb., which is about 170 percent of normal. The civilian allotment should be about 500,000,000 lb., with about 30,000,000 lb. going to Lend-Lease. This leaves about the same amount going to the armed services as they received in 1943.

The short crops of a number of important fruits in 1943 makes the new production schedule difficult. The new program is expected to be an improvement over that of last year. No ceiling prices on fruits for processing are anticipated by WFA, but ceilings will be imposed if necessary.

Production of pectin in 1943-44 reached 6,333,000 lb., while the estimated production for 1944-45 was estimated at 6,500,000 lb., with Lend-Lease requirements reduced.

Freezer space for preservers' fruits in 1944 is questionable. The situation is unfavorable at present, with supplies for the armed forces taking up much of the space.

Field reports show that retail supplies of jams, jellies and marmalades are backing up and that excess stocks are being accumulated because of the high rationing-point value.

Officers Elected

The National Dehydrators Association installed Joseph B. Pardieck, vice-president of California Concentrates,

PACIFIC COAST EDITOR

C. R. HAVIGHORST, who has had fifteen years of practical experience in the distribution and production of foods in the western states, has been appointed Assistant Editor of "Food Industries", with headquarters in the San Francisco offices of the McGraw-Hill Publishing Co., 68 Post St. Mr. Havighorst, who joined the staff of "Food Industries" in September, 1943, has been sales and advertising manager for Bozeman Canning Co and for S. A. Moffett Co. He also served as manager of Moffett's freezing operations in the Rio Grande Valley, Texas. Just prior to coming with "Food Industries," he was Associate Editor of "Western Canner and Packer." The addition of an experienced distribution man to the staff is a part of the post-war preparations of "Food Industries."

Inc., as chairman of the board and Francis J. Holland, president of Little & Co., Chicago, as president. The association approved an aggressive plan for research and sponsored a drive to bring the entire industry into its membership. The Army announced that contracts would be on a new basis involving a fixed ratio of drying and fixed processing charge. The industry was urged to order processing materials and to contract for crops without delay with the expectation of maximum production. No new factories are to be promoted, but additional equipment for existing dehydration plants will be available.

National Canners Association installed the following officers for 1944: President, G. Sherwin Haxton, Haxton Canning Co., Oakfield, N. Y.; first vice-president, Fred A. Stare, Columbus Food Corp., Columbus, Wis.; second vice-president, Alfred W. Eames, California Packing Corp., San Francisco, Calif.; secretary-treasurer, Frank E. Gorrell, Washington, D. C.

All officers of National Preservers Association were reelected.

The new officers of the Canning Machinery and Supplies Association are as follows: President, William De Back, Chisholm Ryder Co., Niagara Falls, N. Y.; vice-president, R. M. Roberts, American Can Co., New York, N. Y.

Food Refrigeration Research Organized

A LONG RANGE program of research dealing with the refrigeration of food and other commodities is planned by the newly organized Refrigeration Research Foundation, which announced the opening of its program with a minimum fund of $250,000 at its disposal. The announcement was made by Roy M. Hagen, of Los Angeles, president of the foundation. The business office of the foundation is at 33 South Clark St., Chicago. H. C. Diehl, formerly principal chemist and chief, Commodity Processing Division, Western Research Laboratory of the U. S. Dept. of Agriculture, is the director, with offices in the Mercantile Building, Berkeley, Calif.

60 Plants to Receive Achievement Award

THE WFA has announced that 60 food processing plants have been named to receive the WFA achievement "A" award. This award is the highest honor that the Federal government can bestow for outstanding accomplishments in the food processing field.

The following plants have been named to receive the award:

H. P. Cannon & Son, Bridgeville, Del.; B. F. Shriver Co., plants in New Windsor and Westminster, Md.; Hanover Canning Co., Hanover, Pa.; B. F. Shriver Co., Littlestown, Pa.; D. E. Winebrenner Co., Hanover, Pa.; Knouse Corp., plants in Chambersburg and Peach Glen, Pa.; H. J. Heinz Co., Chambersburg, Pa.; Idaho Canning Co., Fayette, Idaho; Big Horn Canning Co., Cowley, Wyo.; Kuner-Empson Co., plants in Appleton, Brighton, Fort Lupton, Grand Junction, Greeley, Longmont and Loveland, Colo.; Fairmont Canning Co., plants in Fairmont, Waseca and Winnebago, Minn.; Minnesota Valley Canning Co., plants in Blue Earth, Cokato, LeSueur, Montgomery, Watertown, Winsted and Winthrop, Minn.; Northland Canning Co., Cokato, Minn.; Reid, Murdock & Co., Rochester, Minn.; Crampton Canneries, Inc., two plants in Celina, Ohio; Columbus Foods Corp., Columbus, Wis.; and California Packing Corp., twenty-six plants in eight states and one in Vancouver, B. C.

THE PROCESSING PICTURE

Canners of Grapefruit Juice Get Subsidy

SUBSIDY payments on the 1943-44 pack of canned grapefruit juice for civilian consumption was assured by the CCC issuance of a formal offer to make such payments to canners. Growers now can be paid higher prices than last year for their grapefruit without necessitating an increase in price ceilings to consumers.

CCC has placed a limit on the rates of payment to canners, the maximum being 28½ cents per dozen No. 2 cans, 72 cents per dozen No. 3 cylindrical cans and $1.52 per dozen No. 10 cans. The exact rate to be paid varies with the monthly or seasonal average fruit cost in the three producing areas.

Eggs Dried For Army To 2 Percent Moisture

THE Quartermaster Corps has authorized eight companies to dry whole eggs for the Army in accordance with the new specifications which call for a maximum moisture content of 2 percent. The eight companies designated to follow these stringent specifications are: Armour & Co., five plants; Borden & Co., Fairmount Creamery Co., Henningsen-Denison, Inc., Jerpe Commission Co., Seymour Packing Co., Swift & Co., four plants; Washington Cooperative Poultry and Egg Association.

Food Technologists Meet May 29, 30, 31

THE fifth annual meeting of the Institute of Food Technologists has been scheduled for Chicago's Edgewater Beach Hotel, May 29, 30 and 31. The attention of the three day meeting will be focused upon the war emergency and the postwar problems facing the industry.

A highlight of the conference will be the presentation of the Chicago section's 1944 Nicholas Appert medal award to Dr. Charles Albert Browne, U. S. Department of Agriculture, for

EMPLOYEES GET "E" AWARD

In addition to the "E" pennant which now flies over the J. R. Simplot Dehydrating Co. plant in Caldwell, Idaho, the employees were presented with "E" pins. Three of the workers are shown here displaying their pins for owner Jack Simplot.

outstanding contributions to food technology.

As in the past, the industrial exhibit will be a feature of the meeting. Space will be assigned for 30 exhibits, among which will be that of the Quartermaster Corps Subsistence and Research Development Laboratories.

Dehydration Industry Shows Great Growth

With fewer than 50 companies engaged in any phase of dehydration in 1939, the industry had grown to over 600 manufacturers by the end of 1943, according to a statement of L. K. Harper, past-president, National Dehydrators Association. Including eggs, milk, meat, vegetables, fruit and soups, it is expected that the season from July 1, 1943, to June 30, 1944, will show a total production of around 2,000,000,000 lb. of dehydrated products.

Not only has the primary production of dehydrated foods increased rapidly, but the output of products made in part from them has also shown great growth. For example, the capacity of the producers of dry soup mixes increased to about 200,000,000 lb. annually by the end of last year.

RED CROSS PACKAGE FOR PRISONERS

These items make up the invalid food parcel packed by Red Cross volunteers and shipped to prisoners recovering from illness or wounds. During the past year the Red Cross shipped 7,405,088 such parcels to prisoners throughout the world.

DEVELOPMENTS IN DISTRIBUTION

Old Houses Offer Dehydrated Soups

Without preliminary announcement, Campbell Soup Co. and Wilson & Co. recently placed small lines of dehydrated soups into distribution channels. Campbell is offering vegetable noodle and noodle soup in the New York and Philadelphia areas, while a third variety, pea soup, has been seen but is not now on the market. The soups are being marketed under the Franco-American label.

Wilson & Co. has placed its label on three varieties; noodle, beef noodle and cream of mushroom. Both moves are evident trial balloons in preparation for possible postwar demands for dehydrated soups.

Packaging Exposition Opens on March 28

Exhibits of wartime packaging, packing and shipping, along with postwar developments, will be on view at the 14th annual Packaging Exposition at the Palmer House, Chicago, March 28 to 31. The exposition and the concurrent conference, sponsored by the American Management Association, are expected to draw about 9,000 executives and will be the largest in the association's history. More than 80 companies will have exhibits.

The conference program will include speakers from government and industry. Changes in government specifications for overseas packing, postwar uses of wartime substitutes, trends that will effect packaging after the war and the reuse of containers will be among the topics discussed.

DISA Told of Better Distribution of Milk

The "renovation" of fluid milk distribution and the postwar possibilities in the dairy industry were brought to the attention of the members of the Dairy Industry Supply Association who gathered in New York for the Silver Anniversary meeting on January 25, by E. J. Mather, executive vice-president of National Dairy Products Corp.

In discussing the war-restricted distribution of fluid milk, Mr. Mather declared that the word "renovated" was well chosen. "A method of service to the public that becomes needlessly expensive," he said, "adding to the cost of the product an unreasonable charge for that service, needs to be cleaned up." He pointed out that government regulation has proved that milk need not be delivered to homes every day; that retail loads can be doubled and deliveries made satisfactorily without undue labor strain and that milk can be delivered in the daytime instead of during the early morning hours.

Because of the space saved in refrigeration, Mr. Mather considers the square package both for milk and ice cream as here to stay. "The ice cream business," he said, "has been in the horse and buggy days for a number of years in packing its product, and I am ashamed to admit it but we have been asleep at the switch. We could walk into almost any other food plant that packages its product in America and find efficient mechanical, automatic packaging equipment." Mr. Mather added that truck bodies were also being redesigned for more efficient delivery.

John H. Forslew, chief engineer of Bowman Dairy Co. and WPB consultant, told the association that improved design and workmanship in manufacturing will be one of first results of the war. Milk processors should want dairy machinery made more complete. He thought, for instance, that all dairy

equipment should approach in unity the high-temperature milk pasteurizer. Fillers, sealers and cappers, he said, should be one complete unit. Likewise milk dryers and can washers should come complete with exhaust systems.

Parisius Heads New Office of Programs

APPOINTMENT of Herbert W. Parisius as director of the Office of Food Programs establishes him in one of the most important positions as it affects the food industry in this country. The duties of OFP include the assembly of requirements for commercial needs, Lend-Lease and for UNRRA, the determination of whether these requirements shall be supplied from this country or foreign sources and the development of programs including the reciprocal Lend-Lease programs for procurement of commodities abroad and for imports of commodities to this country in accordance with "directives and recommendations of the War Food Administration.

The organization that Mr. Parisius is to head is authorized to represent FEA on War Food Administration requirements and allocations committees. It also is directed to represent FEA on committees of the Combined Food Board and on other inter-governmental committees.

Another of the duties will be to develop programs for the purchase or production of required commodities in areas outside of this country in accordance with the objectives of FEA.

FOREIGN FOOD DIRECTOR

Herbert W. Parisius, director of the newly established office of Food Programs of the Foreign Economic Administration.

How 1944 Food Production Will Be Allocated

Plans for the allocation of 1944 food supplies among U.S. armed forces, U.S. civilians, our Allies and other claimants have been revised by the War Food Administration to allow for the latest information on supplies and requirements. On the basis of these allocations, and including unallocated foods, it is expected that 13½ percent of total food supplies will go to U.S. military and war services.

Foods shipments to our Allies are expected to take 11½ percent of food supplies. U.S. civilians will receive only 75 percent of available supplies, but this quantity will be little different in both amount and nutritive value from either 1943 or from the average prewar diet. Allocations follow:

Commodity	Total	Contingency reserve	U. S. Military and war services	Total Lend-Lease	Other exports and shipments	U. S. civilian
	Million bushels farm weight					
White potatoes	401.3	.0	40.5	1.2	3.3	356.3
	Thousand bushels, farm weight					
Sweet potatoes	67,150.0	.0	3,360.0	.0	191.0	63,599.0
	Thousand cwt.					
Dry edible beans	23,027	1,000	3,442	6,217	868	11,500
Dry edible peas	6,800	988	300	3,366	146	2,000
	Thousand 100-lb. bags milled					
Rice	17,904	1,000	1,217	1,471	6,716	7,500
	Thousand pounds					
Beverages						
Tea	92,700	0	14,425	828	947	76,500
Coffee, green	2,615,355	0	488,549	19,150	14,656	2,093,000
Cocoa beans	704,983	0	174,900	9,118	12,565	508,400
Miscellaneous						
Compressed yeast	248,203	0	15,930	0	3,505	228,768
Dry active yeast	12,932	0	8,490	3,878	144	420
Nutritional yeast	11,448	1,000	0	2,448	0	8,000
Dry onions	1,565,000	.....	245,735	4,538	58,549	1,256,178
	Thousand pounds frozen weight					
Frozen vegetables	233,000	.....	74,053	0	1,089	157,858
	Thousand equivalent cases of 24 No. 2½'s					
Canned fruit and fruit juices (other than citrus)	61,428.0	4,792.2	18,575.8	2,015.3	690.3	35,354.4
	Million pounds farm weight					
Citrus fruit—Total	13,034	0	1,925	715	628	9,766
Fresh	9,218	0	856	2	477	7,883
Canned	2,573	0	960	2	108	1,503
Concentrates	1,023	0	41	703	43	236
Dehydrated	58	0	58	0	0	0
Marmalades	49	0	10	1	neg.	38
Citric acid	106	0	0	0	0	106
Citrus squash	7	0	0	7	0	0
	Million pounds					
Dairy products						
Butter	2,046.1	10.0	366.5	102.2	11.4	1,556.0
Cheese, American	797.6	60.0	146.7	214.4	16.5	360.0
Cheese, other	189.5	.0	9.0	.1	.4	180.0
Evaporated milk	3,302.2	170.0	935.9	370.7	85.6	1,740.0
Condensed milk	260.0	4.0	3.9	52.6	8.8	190.7
Dried whole milk	130.0	.0	54.3	28.7	28.0	19.0
Dried skim roller	239.4	8.0	24.0	120.9	6.5	80.0
Dried skim spray	252.4	8.0	33.9	130.7	1.8	78.0
	Million pounds dried weight					
Total meats	25,574	1,142	4,333	2,877	224	16,998
	Million dozen					
Eggs						
Fresh and frozen	4,092.2	.0	363.4	.3	7.2	3,721.3
	Million pounds					
Dried whole	297.3	.0	78.4	216.7	2.2	.0
	Million pounds fat content					
Fats and oils (excl. butter)	10,095.0	109.7	789.9	1,437.9	210.8	7,546.7
Food uses	6,206.3	109.7	403.4	422.5	174.7	4,096.0
Non-food uses	3,888.7	.0	386.5	15.4	36.1	3,452.7
	1,000 cases of 24 No. 2's					
Canned vegetables	271,934	14,819	56,268	7,621	2,255	190,971
	1,000 lb. dehydrated weight					
Dehydrated vegetables	210,636	7,759	126,161	68,551	65	8,100
Dehydrated soups	111,480	0	32,889	27,466	1,125	50,000
	Thousand pounds, farm weight					
Apples	4,423,400	275,518	753,070	142,101	22,341	3,230,370
Fresh	2,849,608	0	458,067	1,060	15,862	2,374,619
Canned	387,091	72,126	117,814	969	4,863	191,319
Apple butter	72,162	0	2,198	0	153	69,811
Dried	401,600	203,392	59,728	138,080	400	0
Dehydrated	78,230	0	78,230	0	0	0
Frozen	22,000	0	185	0	0	28,815
Jellies	121,522	0	21,662	1,700	600	97,560
Vinegar	371,187	0	15,186	292	463	355,246
Cider	120,000	0	0	0	0	120,000
	Short tons, processed weight					
Dried fruit	623,500	62,570	97,897	143,262	36,849	282,922
	Thousand pounds farm weight					
Cranberries	72,500	0	13,595	2	2,632	56,271
	Thousand pounds, processed weight					
Jams, jellies, etc. (exclud. pectin)	598,428	0	159,552	19,521	5,065	414,290
	Thousand pounds					
Fish canned	727,775	132,831	83,858	151,973	27,031	332,082
	Million pounds (edible weight)					
Fish, fresh, frozen and shellfish	660.0	0	98.0	0	0	562.0
	Million pounds (dry salt basis)					
Fish cured						
Cod and other ground fish	32.0	0	1.6	0	18.3	12.1
	Million pounds (cured weight)					
Other cured fish	93.3	0	1.1	0	10.2	87.0

ODT Asks Cut in Use Of Refrigerator Cars

OFFICE of Defense Transportation has asked for a voluntary curtailment of the use of refrigerator cars, particularly during the period when seed potatoes are being moved to market. The request was aimed at shippers of beer, wine and canned goods. The Office of Defense Transportation has pointed out that if the reduction is not made voluntarily, Interstate Commerce Commission will have to step into the picture with drastic orders curtailing the use of cars. Inquiry at the Office of Defense Transportation and Interstate Commerce Commission reveals that this is no idle threat.

Outlook Not Good for Packaging Materials

PAPER and pulp products are so tight that Limitation Order L-319, which restricts the manufacture, delivery and use of fiber shipping containers (it also establishes quotas and inventory restrictions) may be revised in the near future.

If it is, the quotas will be reduced and the whole order tightened considerably.

Wooden shipping containers of all kinds will be equally scarce, and wood containers for handling food in the civilian market are in a position to be among the first cut if lumber production falls off.

Relaxation of the limitation order governing the use of cellophane to permit its use for milk bottle hoods has no particular meaning as far as the rest of the food industry is concerned. Only 15 or 20 thousand pounds of cellophane per month are involved. Actually the general provisions of the order controlling the use of cellophane have been tightened. No immediate relief can be expected since cellulose plastics have been adversely affected by the depletion of the phthalate plasticizer stockpiles. Non-essential uses such as counter wrapping will not be permitted.

SCHEDULE OF EVENTS

MARCH

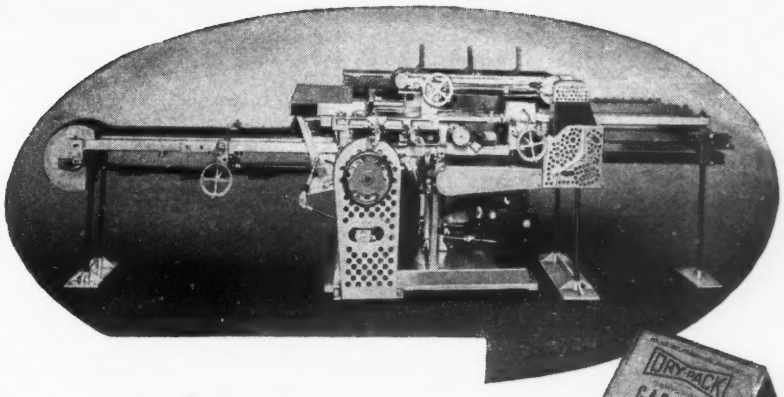
6– 9—American Society of Bakery Engineers, 21st annual meeting, Edgewater Beach Hotel, Chicago.

28–31—Packaging Conference and Exposition, sponsored by American Management Association, Palmer House, Chicago.

30–31—Wisconsin Dairy Manufacturers Annual Conference, Department of Dairy Industry, University of Wisconsin, Madison, Wis.

APRIL

3– 7—American Chemical Society, agricultural and food division, Cleveland, Ohio.



Auto-Ordnance selects the FA for DEHYDRATED FOOD WRAPPING

Serving the Armed Forces and Lend-lease, the Auto-Ordnance Corporation requires wrapping which will protect its dehydrated foods on their long journeys to many parts of the globe, as well as under all climatic conditions.

Our well-known and widely used FA models have been selected for this important job. These machines produce the tight and dependable seal required, using a special laminated moisture-proof wrapping material. They are quickly adjustable for the wide range of package sizes used. And they have SPEED—the vital factor in winning the war and in serving the urgent needs of civilian populations.

If you require wrapping machines for war or essential civilian supplies, call on us.

PACKAGE MACHINERY COMPANY
Springfield 7, Massachusetts

NEW YORK CHICAGO CLEVELAND
LOS ANGELES TORONTO

See us at the
PACKAGING EXPOSITION
Palmer House, Chicago
March 28-31
BOOTH 207-208

PACKAGE MACHINERY COMPANY
Over a Quarter Billion Packages per day are wrapped on our Machines

Bronze Bearing

A BIT of bronze in your product — that's all — but it can break a tooth! "Stoning" — removing such dangerous saboteurs from your product as that bit of bronze — has been streamlined. To eliminate this great headache of the cereal, soy-bean, and other dry food processors, we have developed a new type stoner — revolutionary in design, amazing in efficiency, low in first cost, in operation. Removes stones, glass, non-magnetic metals, and all other hard, dangerous contaminations from cereals, soy-beans and other beans, and other food products, with, 1) an action so sensitive the tiniest particles are easily removed; and 2) operating cost so low it is relatively insignificant; and 3) 99.9% efficiency. Capacity up to 16 tons per hour. Write for Bulletin FI-344.

SUTTON, STEELE & STEELE, Inc.
DALLAS, TEXAS
In Canada — Kip Kelly, Ltd., 68 Higgins Ave., Winnipeg
Foreign — Separations Engineering, Ltd., 133 Bush House, Aldwych, London

Reuse of Containers Is Urged by the WPB

THE containers division of WPB is sponsoring a "Container Reuse Program" to help relieve the present critical shortage of all types of containers.

They are asking the voluntary cooperation of industry wherever it is practicable.

Packers are especially urged to reduce the amount of glue used in sealing fiber containers, as this facilitates opening of the boxes without causing excessive damage. WPB declares that many companies have changed from tight to spot sealing, which results in a much larger percentage of containers being fit for reuse. Another method recommended is for the shipper to have a message printed on the flap of the fiber container, such as "Open Carefully—Save for Reuse".

Heads OPA Branch

DAIRY Products, Fats and Oils Rationing Branch of the Office of Price Administration is now headed by Irving C. Reynolds, president of the Franklin Creamery Corporation, Toledo, Ohio, who was appointed chief to succeed Louis A. Baumann.

RAW MATERIALS REVIEW

Pickle Packers Ask Cucumber Increase

THE outlook for the 1944 cucumber crop is reported by the Pickle Packers Association to be no brighter than that of 1943, which was about 25 percent less than in 1942. In an attempt to obtain as much acreage as possible, without taking acreage away from other vegetable crops favored by the Department of Agriculture, a rural newspaper advertising program is being promoted through the Western Newspaper Union, appealing for the planting of cucumbers for previously unused acreage.

WPB has allotted pickle packers 25 percent more glass containers and closures for 1944 than was used in 1943. Salt stock on hand on January 1, as reported by 43 members of the association was 1,922,218 bu. as compared with 3,117,117 bu. on January 1, 1943. Genuine dill stock on hand was 42,120 bu. as compared with 54,651 bu. a year ago. On the basis of acreage represented by the 43 reporting members, the indicated national inventory of salt stock and genuine dills was 5,801,352 bu. as compared with 7,072,669 bu. on Oct. 1, 1943 and 6,555,948 bu. on Jan. 1, 1943.

Officers elected for 1944 at the recent Chicago convention of the association are: President, John T. Miller, W & W Pickle Co., Montgomery, Ala.; vice-president, Lewis A. Hirsch, Hirsch Bros., Louisville, Ky.; treasurer, C. J. Sutphen, C. J. Sutphen & Co., Chicago; secretary, E. T. Miller, Oak Park, Ill.

Production Goals Up For 1944 Food Crops

WITH acreage planted in 1944 increased to 380,000,000 acres from the 364,000,000 acres planted in 1943, Secretary of Agriculture Wickard has called on American farmers to increase food output this year. In 1943, crop production was 6 percent less than in 1942, but livestock production was up about 10 percent, giving an overall output about 5 percent over 1942, the previous record year.

In 1944, production of meats, dairy

STABILIZERS
WATER SOLUBLE GUMS
TRAGACANTH • LOCUST (CAROB) • ARABIC • KARAYA
IRISH MOSS
QUALITY CONTROLLED FOR UNIFORMITY IN YOUR PRODUCT
S. B. PENICK & COMPANY
IMPORTERS • CHEMICAL MANUFACTURERS • MILLERS
735 W. Division Street—MOHawk 5651 Chicago 10, Ill.
50 Church Street—COrtlandt 7-1970 New York 7, N. Y.

products and eggs is expected to be maintained at a high level, and output of direct consumption crops such as wheat, beans, peanuts, peas and vegetables is expected to be increased.

Milk Production Up, New Increase Asked

RECORDS have been made by milk producers in recent years and the War Food Administration expects an even higher output for 1944. Total milk produced in 1941 was 115,498,000,000 lb.; in 1942 was 119,240,000,000 lb.; and in 1943 was 118,235,000,000 lb. In 1944, WFA has asked farmers to increase herds by 2 percent and output per cow by 5 lb. This would bring total production for the year to 122,000,000,000 lb., a new high record.

Of the milk produced in 1943, it is estimated by the Bureau of Agricultural Economics that 22,000,000,000 lb. was used on farms and 96,000,000,000 was sold by farmers. Of the milk sold by farmers, 39,000,000,000 went to fluid milk, including that used by the armed forces; 9,800,000,000 lb. went into cheese; 7,200,000,000 lb. was used for evaporated and condensed milk; 4,200,000,000 for ice cream; 1,000,000,000 lb. for dried whole milk; and 34,000,000,000 lb. was used in making butter.

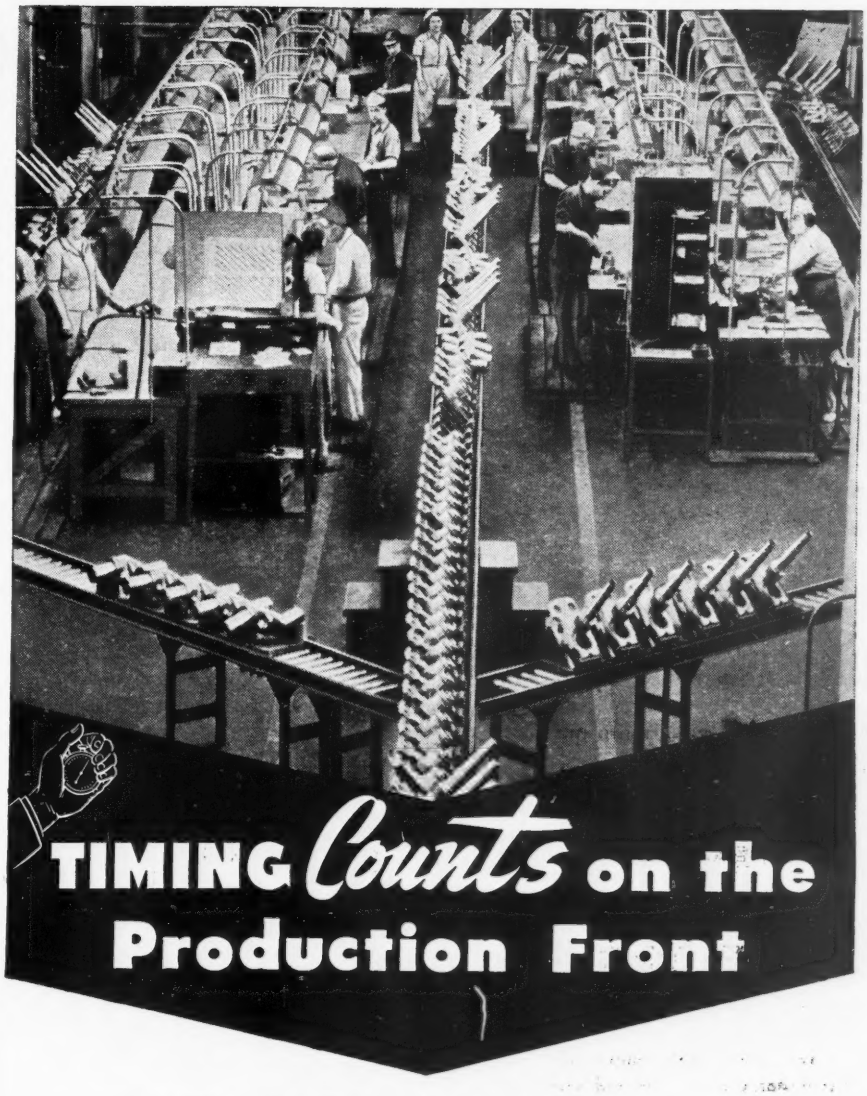
Dividing this milk production another way, the BAE reports that U. S. civilians used 100,300,000,000 lb. of milk; the armed forces used 10,200,000,000 lb.; Lend-Lease took 4,700,000,000 lb.; 700,000,000 lb. was shipped to U. S. overseas possessions; and 2,200,000,000 went into reserves or stockpiles of dairy products.

More Sugar Allotted To Move Frozen Fruit

SUGAR ALLOTMENTS for preserves have been changed by OPA in an effort to promote a more rapid movement of frozen fruits from storage. Bakers, ice cream makers and other industrial users also have been permitted to increase their use of frozen fruits at once.

Preservers now are allowed to use sugar at the rate of 0.67 lb. per pound of finished product, with no limit on the amount of sugar that may be used. The sugar is available for all the frozen fruit they may have or can get.

OPA also provides that manufacturers who make spreads of synthetic products used as substitutes for fruits and fruit juices may obtain either 0.67 lb. of sugar for each pound of finished product or the average amount used per pound of finished product in 1941, whichever is less.



TIMING *Counts* on the Production Front

. . . controlling the flow of material saves man-hours and makes certain that delivery schedules will be met

On the playing fields of sport—and on the field of battle — success depends on *timing*, rhythm of motion. Timing is a vital element in production, too.

Having the right material at the right place at the right time — just enough of it and not too much — is a characteristic of efficient production.

Keeping production synchronized — timed — involves planning all along the line, to relieve congestion at one point, speed up movement at another, to the end that goods will be produced with precision and speed, and at an economical cost.

Conveyor engineering, applied like Standard does it, accomplishes all these things. If you feel that *timing* could be improved in your plant — check with Standard.

"Conveyors by Standard" — Catalog No. FI-3 is yours for the asking. Why not write today?

Sales and Service in Principal Cities

STANDARD CONVEYOR COMPANY

General Offices:
North St. Paul, Minn.

★ ENGINEERED FOR FASTER PRODUCTION ★

YES!.....

EVERY
Potato Chip has
UNIFORM QUALITY!

A continuous flow of uniformly-finished potato chips is assured with

FERRY CONTINUOUS POTATO-CHIP MACHINES

The "profitable" potato chip is one that has uniform size, color and saltiness. Ferry Machines make chips having *all* these qualities . . . because the whole process is done automatically—with precision!

You merely feed raw, unpeeled potatoes into the machine, and by push-button control they're automatically peeled, washed, sliced, conditioned, dried, fried, salted and cooled.

Ferry Machines are compact . . . rigidly built in 5 various sizes . . . produce from 100 to 450 lbs. of finished chips per hour, depending on the size machine.

There's lots more to know about Ferry. Write immediately for Bulletin F-1.

Also makers of
SLICERS AND AUTOMATIC SLICERS FEEDERS AND CAN WASHING MACHINERY

J. D. FERRY CO.
129 SO. CAMERON ST.
HARRISBURG, PA.

INDICATORS

Production

Butter, creamery, produced in 1943 totaled 1,685,825,000 lb., according to the Bureau of Agricultural Economics. Production in 1942 totaled 1,775,398,000 lb. and the 1932-1941 average was 1,731,420,000 pounds.

Cheese, American, produced in 1943 totaled 771,410,000 lb., compared to 921,207,000 lb. in 1942, and to a 1932-1941 average of 511,724,000 lb., according to the Bureau of Agricultural Economics.

Evaporated milk produced in December, 1943, totaled 168,100,000 lb., compared to 178,333,000 lb. in December, 1942, and 6 percent over the 1937-1941 December average. Production in 1943 totaled 3,075,048,000 lb., down 13 percent below output in 1942.

Condensed milk, all kinds, produced in December, 1943, totaled 54,449,000 lb., compared to 53,828,000 lb. in December, 1942. For the year 1943, production was 838,558,000 pounds.

Milk, dried, whole, produced in December, 1943, was 9,650,000 lb., compared to 7,097,000 lb., produced in December, 1942, and 318 percent over the 1937-1941 average December production. For the year 1943, total output was 124,300,000 lb., an increase of 96 percent over production in 1942.

Milk, dried skim, all kinds, produced in December, 1943, totaled 23,995,000 lb., down 30 percent below December, 1942, and 19 percent below the 1937-1941 average December production. For the year 1943, output was 477,881,000 lb., a falling off of 24 percent from the production of the preceding year.

Fruit, dried, packed in 1943 is estimated at over 600,000 tons, of which about one-half was raisins and one-third was prunes. This exceeded the 1942 pack by about 15 percent.

Shrimp packed in 1943 totaled 450,000 cases compared to 692,000 a year earlier.

Salmon pack in Alaska in 1944 is expected to be about 5,200,000 cases, compared to 5,412,000 cases in 1943, because it is believed that the run of pink salmon in southeastern Alaska will be small.

Mussels canned in 1943, in Maine and Massachusetts, totaled 40,000 cases.

Flour production in January, 1944, by mills accounting for 73 percent of United States production was 14,993,239 sacks of 100 lb. each, according to *The Northwestern Miller*, compared to 15,898,464 sacks in the preceding month.

In Storage

Poultry, frozen, all kinds, in storage on February 1, 1944, totaled 239,800,000 lb., compared to 142,002,000 lb. on February 1, 1943, and to an average in 1939-1943 of 168,005,000 lb. for the date.

Meat, all kinds, in cure and frozen storage, was 1,064,902,000 lb. on February 1, 1944. A year before the total was 801,400,000 lb. and the average for the date in 1939-1943 was 814,922,000 lb.

Lard in storage on February 1, 1944, totaled 230,496,000 lb. and rendered pork fat on the same date was 15,865,000 lb. The combined figures for these products a year earlier totaled 111,867,000 lb., and the combined average for these products in 1939-1943 was 192,496,000 lb. for the same date.

Eggs, case equivalent, in shell and frozen storage on February 1, 1944, amounted to 2,939,000 cases compared to 1,808,000 cases a year before and to a February 1 average in 1939-1943 of 1,788,000 cases.

Vegetables, frozen, in storage on February 1, 1944, totaled 170,108,000 lb., compared to 92,344,000 lb. on February 1, 1943 and to a 1939-1943 average of 75,066,000 lb. for the date.

Butter, creamery, in storage on February 1, 1944, amounted to 129,952,000 lb. A year earlier the figure was 15,607,000 lb. and the average February 1 figure in 1939-1943 was 53,794,000 pounds.

Cheese, all kinds, in storage on February

CHANGE OF ADDRESS

McGRAW-HILL PUBLISHING COMPANY
330 West 42nd Street, New York, N. Y.
Director of Circulation:
Please change my address on "Food Industries"

From.....

.....

To.....

.....

Signed.....

CONSTRUCTION NEWS

	Pending (thousands)	Awarded February (thousands)	Total Awarded 1944 (thousands)
Bakery	$55	.....	.....
Beverages	90	.....	.....
Canning and Preserving	120	.....	.....
Cold Storage	190	.....	$190
Confectionery	.....	.....	.....
Grain Mill Products	1,770	.....	.....
Ice Manufactured	.....	.....	40
Meats and Meat-Products	.....	$40	40
Milk Products	130	438	438
Miscellaneous	625	80	80
	$2,980	$558	$788

1, 1944, was 167,496,000 lb., compared to 113,797,000 lb. on February 1, 1943 and to an average in 1939-1943 of 121,072,000 lb. for the date.

Fish and fishery products in cold storage on January 1, 1944, totaled 98,888,105 lbs., while salted and smoked fish in storage on the same date totaled 10,640,345 pounds.

Fruits, frozen, in storage on February 1, 1944, totaled 208,582,000 lb., compared to 172,103,000 lb. a year earlier and to a 1939-1943 average of 138,489,000 lb. for the date.

Raw Materials

Eggs, dried, produced in December, 1943, totaled 21,515,000 lb., compared to 13,144,000 lb. produced in December, 1942. Production for the year 1943 was 262,453,000 lb., compared to 237,638,000 lb. produced in 1942.

Eggs, liquid, produced in December, 1943, for drying, freezing, or immediate consumption totaled 31,032,000 lb., compared to 30,556,000 lb. in the preceding year.

Chicks hatched by commercial hatcheries in December, 1943, numbered 21,596,000 compared to 29,278,000 in December, 1942, and to a 1938-1942 December average of 20,447,000 birds. For the complete year of 1943 hatchings were 1,427,445,000 birds, compared to 1,199,988,000 birds in the preceding year.

Indexes

Business activity index of *Business Week* stood at 242.8 on February 12, 1944, compared to 241.7 a month earlier and to 226.6 a year before.

Wholesale commodity price index for foods, compiled by Irving Fisher, was 121.0 on February 18, 1944, compared to 121.2 a month earlier and to 119.7 for the corresponding 1943 date.

Cost of living index of National Industrial Conference Board stood at 103.9 in January, 1944, compared to 101.5 a year earlier, and to 103.9 in December, 1943.

Baker Truck HELPS WAREHOUSE

SAVE $7956.00 PER YEAR

On the recommendations of a Baker material handling engineer, a large midwest grocery warehouse made the investment outlined at the right. Enough time has passed since the installation to compute actual savings.

In addition to the money earned, this equipment reduced handling time, conserved man power, cut rent cost by higher tiering, and minimized damage to cartons. Start planning now with Baker's help so that you can realize similar advantages.

FACTS AND FIGURES

- ★ **Subject**—Large grocery warehouse
- ★ **Investment**—Baker Hy-Lift Truck and conveyor system
- ★ **Total Cost**—$16,375.25
- ★ **Operating Cost**—
  Prior to investment—$0.668 per ton
  After investment —$0.498 per ton
- ★ **Reduction**—$0.17 per ton, or 25.4%
- ★ **Tons Handled**—Average 900 per week
- ★ **Gross Savings**—$153.00 per week
  $7956.00 per year

These figures show how a capital investment of $16,375.25, written off completely in five years, earned from $4680 net profit the first year to $7596 the fifth and each year thereafter.

BAKER INDUSTRIAL TRUCK DIVISION of the Baker Raulang Company
2146 WEST 25th STREET • • • • CLEVELAND, OHIO
In Canada: Railway and Power Engineering Corporation, Ltd.

Baker INDUSTRIAL TRUCKS

OPA Price Regulations

Green Coffee—Storage charges for 90 days instead of the present limit of 30 days may be added to the maximum prices for green coffee placed in warehouses before July 1, 1944. The change, embodied in Amendment 9 to RPS 50, is designed to encourage immediate importation of obtainable coffee.

The maximum prices listed for green coffee must be reduced by the customary trade discount for cash and by a 1 percent discount for shrinkage when those are applicable, according to Amendment 8 to RPS 50, effective January 28. It is made clear, however, that all commissions and charges incurred in delivering the coffee to the points of entry into the United States, which are named in the regulation, are included in the listed prices.

Cider Vinegar—Processors and secondary packers of cider vinegar are authorized to determine their maximum prices by adding 8½ cents a gallon to their established maximum prices for 60-grain cider vinegar in Amendment 3 to MPR 428, effective February 5. Specified other amounts converted from the 8½-cent figure according to grainage strength are provided for other grades and quantities.

Sweet Potatoes—Without altering other provisions of the sweet potato price freeze, Amendment 1 to Temporary MPR 34 removes those sold to dehydrators from price control. This action was taken to overcome the difficulties dehydrators were experiencing because growers preferred to sell to purchasers who were permitted to pay higher prices.

Frozen Fruits—Bakers, ice cream makers and other industrial users of bulk frozen fruits are allowed a temporary increase in the use of such fruits by Amendment 6 to revised RO 13, effective February 13. The action was taken to help clear freezer storage of these commodities to provide space for meat. It was explained that the amendment does not increase the total supply that will be available for these manuufacturers, as the increases allowed now will be deducted from later allotments.

Soybean Oils—Maximum prices for increased soybean oils are increased from 0.07 cent to 0.40 cent by Amendment 13 to MPR 53, effective February 2. This action was similar to that taken recently for cotton-seed oil and was necessitated by the termination of a CCC payment which had been made on oils from the 1942 crop.

Vitamin A—In a move to discourage blending operations, OPA has issued a revised schedule for maximum prices at production levels for vitamin A natural oils and concentrates. The provisions were approved by representative members of the vitamin A industry and are included in Amendment 1 to MPR 203, effective January 26.

Smoked Pork Tongue—Reduced maximum prices for smoked pork tongues at retail are set by Amendment 13 to MPR 355, effective February 3 to establish a proper relationship with the revised wholesale prices for the commodity. The new prices range from 4 to 5 cents less per pound.

Cane Sirup—A more sharply drawn line of distinction between country and commercial cane sirup is drawn by Amendment 1 to RMPR 291. Effective January 26, country cane sirup is defined as the product of a mill that is now equipped for the production of cane sirup only and is not now or was not equipped with machinery to manufacture sugar during the 1941 cane grinding season. Commercial cane sirup is the product of a mill so equipped now or during the 1941 season.

Vegetables—Maximum prices at all levels except retail for carrots, spinach, peas, snap beans, eggplant, peppers and cucumbers are set by Amendment 18 to MPR 426. The action was taken to prevent last winter's sharp increases in fresh vegetable prices and was effective January 31 for the country shipper level and February 15 for the terminal market level.

Shortening—Higher ceiling prices are fixed by amendment 12 to MPR 53 on shortenings sold in bulk to government agencies to align these prices with recent payments made by the CCC on shortenings sold in the civilian market. The increases range from 0.2 to 0.4 cent a pound.

Dry Peas—Whole and split dry peas are brought under price regulation by amendment 1 to 2nd RMPR 270, effective January 26. The f.o.b. country shipping point maximum prices for No. 1 whole dry peas are established by adjusting the 1942 support prices to cover processing, cleaning, delivering and bagging costs incurred by the country shipper. Lower grades reflect the usual differentials between grades in the trade.

Apples—Processors who purchase apples and other apple products from government agencies are given ceiling prices in Amendment 3 to MPR 493, effective February 3, for resales into civilian channels. The maximums established for civilian sales of the same product processed from apples of the 1943 crop are to be used. This provision is made in place of a relabeling requirement to show year of pack of the products being released.

Sesame Oil—Amendment 101 to RO 16, effective January 25, places sesame oil under rationing. Manufacturers who used sesame oil during 1942 and who are already registered as industrial users may apply at their local boards for an increase in their ration-point alotment to cover oil. Users in 1942 not so registered must register with their boards as industrial users. In general, manufacturers who did not use sesame oil in 1942 will not be issued points to buy it even though they are using it now.

Dry Beans—New packaging allowances for dry beans are established by Amendment 2 to RMPR 270 effective January 31, that just about wipe out the previously announced reduction in prices at the retail level. The amendment was in line with suggestions made by an industry committee.

Grapefruit Juice—Processors of packed grapefruit juice of the 1944 pack are authorized by Amendment 27 to MPR 306, effective January 27, to sell government procurement agencies at "open" prices. The prices are to be adjusted to the maximums which are to be announced by OPA in the future. This action was necessary because the armed forces had found it impossible to buy the new pack at the 1943 maximums and because a serious congestion was developing in processors' inventories. The 1944 prices will be higher on government sales.

Sliced Codfish—A reduction of 4 to 4½ cents per pound in the winter ceiling price and 3 cents per pound in the summer ceiling price of fresh sliced codfish is announced through Amendment 23 to MPR 418, effective February 14.

Fresh Fish and Seafood—Authority of the Regional Administrator for OPA Region VIII (California, Washington and Oregon) to set maximum prices on otherwise uncontrolled fresh fish and seafood is broadened by Amendment 22 to MPR 418 to permit the regional head to set ceiling prices within the region for uncontrolled styles of dressings of fish and seafood species which are now under limited control on a national basis.

Canned Citrus Juice—Processors' maximum prices for the 1944 pack of canned grapefruit juice, grapefruit segments, orange juice and blended orange and grapefruit juice are established by MPR 509, effective February 4. Except for grapefruit segments, all of which will go to government procurement agencies, two sets of prices are fixed, one for civilian sales and one for government. Only Texas and Florida orange juice and blended juice are fixed by this regulation. The California and Arizona pack prices for these juices will be established later.

Sunflower Seed Oil—Under amendment 103 to RO 16 sunflower seed oil, an imported oil used in shortening and like foodstuffs, is placed under rationing.

Sugar—The sugar rationing program is extended to bring under control the use of imported sugar containing products such as sirup and "candy" crystals used industrially in the place of rationed cane and beet sugar. The regulation is made in Amendment 1 to Revised RO 3 and limits the use of imported sugar-containing products to the amount used during the corresponding period of 1941.

WFA Orders

Fish Oils—Storage charges on fish oils that actually have been stored by the WFA may be added to established maximum prices on sales to war industries according to Amendment 15 to MPR 53, effective February 14. The amendment authorizes specific charges for both East and West Coast.

Set-Aside Beef—Packers operating under Federal inspection have been ordered to set aside at least 80 percent of all canner and cutter beef for the armed forces. The regulation, issued as Amendment 6 to FDO 75.2, became effective January 30 and brought to an end the period in which there was no limitation on the quantities of canner and cutter beef that could be delivered to civilians.

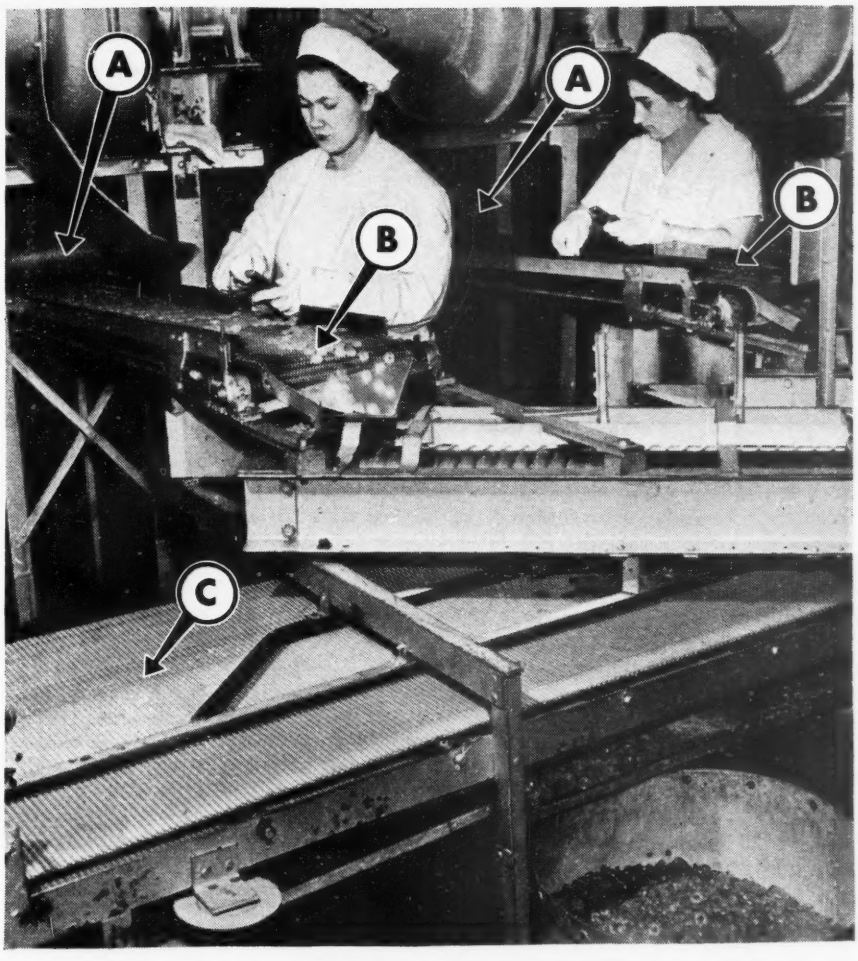
Concord Grapes—Supplies of Concord grapes required to be set aside under FDO 80 and which have not been allocated for use in the manufacture of fruit spreads or the production of bottled grape juice are released from set-aside restrictions by an amendment to FDO 80.1, effective February 6. The action permits the remaining supplies of unallocated Concord grapes to be used in the production of any product except one containing an alcoholic content of 7 percent or more by volume.

Vitamin A—Civilians will receive 88 trillion USP units out of a total of about 139 trillion USP units of vitamin A in 1944, according to the allocations announced by WFA. This represents slightly more than 63 percent of the total 1944 allocation and is about the same quantity as was available for civilians in 1943.

Raisins—West Coast packers are authorized to make available for sale to civilians 54 million pounds of raisins from the 1943 pack. This allocation is made possible by the record production in 1943 and brings the total quantity of raisins released by WFA from the 1943 pack to 336 million pounds.

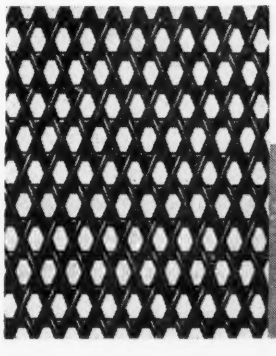
Milk—As part of the WFA program to obtain the most efficient use of the nation's milk supply, WFA has directed more milk into Cheddar cheese, butter, dried skim milk, evaporated milk and other war-important dairy products, through FDO 92. For war purposes, Cheddar is the most valuable cheese type because it keeps and ships best under the difficult climatic, storage and transportation conditions. It is also the variety most preferred by civilians. In recent months, however, increasingly large quantities of milk were being drawn into the production of other cheeses. Cottage, pot and bakers' cheese, which are not affected by this order, are restricted by FDO 79.

Dried Apricots—There will be no dried apricots available for civilian consumption from the 1943 pack, according to WFA, because of the exceptionally small crop last year. A supply will be released, however, to civilian hospitals.



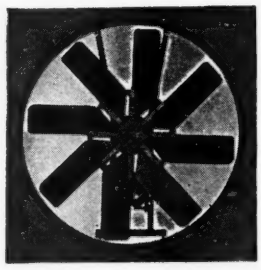
Synchronized Self-Loading Flow From Belts A to Belts B to Belt C

Self-loading and self-unloading Audubon Metalwove Continuous Conveying and Processing Belts provide a smooth, uniform, labor-saving flow of food products from one manufacturing step to another. In this photograph, Belts A feed to Belts B in a battery of such units and Belts B feed to a single conveyor Belt C, which carries the product to the next manufacturing step. Speeds of all belts are synchronized with the rate of plant production, so that each worker has enough to do all the time. There are no "money wasting" periods of idleness or "inefficiency" periods of too much to do, which frequently result where batch methods are used instead of modern Audubon Continuous Methods. . . . This photograph could have been taken in almost any kind of food processing plant for the money and labor saving principles it illustrates would be the same for canners, dehydrators, quick freezers, bakers, candy makers, etc. . . . Better plan your post-war needs now, if you want to save time later in getting new equipment for peace-time production. Our engineers are at your service.



AUDUBON
WIRE CLOTH CORPORATION
Subsidiary of Manganese Steel Forge Co.
2807 Castor Ave · Philadelphia · Pa.
Representatives In Most Principal Cities

INSURE FUTURE DELIVERY
. . . by placing orders NOW
for Coolair TRADE MARK



EXHAUST FANS
for SCIENTIFIC VENTILATION

While WPB Regulations do not permit us to accumulate a warehouse stock of Coolair Fans, our plant has been able, up to now, to make reasonably prompt shipment on all priority rated orders, but . . .

Because this favorable situation may not prevail at the time you plan to install Coolair Fans in your plant we suggest that you figure out the number of fans you will need to solve your ventilating and cooling problems and place orders now while the necessary materials and supplies are still available for manufacture.

CATALOG PAGES
Fan models, dimensions and performance data can be found
in SWEET'S
ASHVE GUIDE and
ELECTRICAL BUYER'S
REFERENCE

Should CMP Regulation 5 not cover your requirements, file form PD-1A with your nearest WPB Field Office. All orders must bear a priority rating of AA-5 or better.

AMERICAN COOLAIR CORPORATION
"Pioneer Manufacturers of V-Belt Drive Exhaust Fans"
3604 Mayflower Street Jacksonville 3, Florida

GUARANTEED
TO MEET THE CONDITIONS FOR WHICH THEY ARE SOLD . . .
FREDERICK PUMPS
Available in the types, sizes and materials best suited to your needs.
Specially designed for efficient service in the food industries.

THE Frederick IRON & STEEL CO.
Frederick, Maryland

Details upon request, no obligation.

Hog Slaughtering—Another extension for the unrestricted sale of pork from home slaughtered hogs has been granted by WFA, this time to March 17. On November 17, WFA suspended restrictions for three months. Farmers are still required to collect ration stamps for pork delivered.

Eggs—Further plans for carrying out its shell-egg price-support program have been announced by WFA. Carlot support prices for designated U. S. grades and sizes of eggs which will reflect the average support prices to producers are to be specified periodically for all areas. These carlot prices are to be supported primarily through the purchase of dried eggs and by the purchase of shell eggs at the announced prices to the extent necessary.

Soup Powder—Early release of 4,000 cases of dry pea and soya soup powder was announced by WFA on January 27. These stocks, amounting to approximately 120,000 lb., are a portion of the government reserves held for war needs.

Fats and Oils—WFA will consider appeals from users of fats and oils who are confronted with exceptional or unreasonable hardship because of uneven operations under quotas prescribed on a calendar quarter basis in various food distribution orders. The relief intended is to permit such users to equalize their quarterly production so as to avoid a manpower problem which might arise if they had to curtail employment during calendar quarters of small production and find additional labor during periods of larger production. FDO's 34, 42, 60 and 63 are involved.

Dehydrated Vegetables—Continuance of monthly reports by processors of dehydrated vegetables is required by an amendment to FDO 30.1, which stipulates that such reports must be submitted on the regular report form irrespective of whether the commodities which they dehydrate are still reserved under the order.

Canned Milk—While the 1944 civilian allocation of evaporated and condensed milk is less than that received by civilians during all of 1943, it is not substantially different from the rate of purchase since rationing of these milks began last June, according to a WFA announcement on February 7. Civilians will receive 1,740,000,000 lb., which is 590,000,000 lb. lower than the 1943 figure.

Frozen Vegetables—More frozen vegetables for U. S. civilians during the coming months was forecast by WFA in announcing revised allocations of these commodities for the year ending June 30, 1944. Civilians should receive approximately 158,000,000 lb., or about 28,000,000 lb. more than they received during the 1943-44 crop year. The remainder of the year's record high production of 233,000,000 lb. will go to the armed forces except for a small quantity being shipped to Hawaii.

Brewers' Hops—In a move to assure better distribution of the available hop supply, WFA provides that no brewer shall buy,

contract to buy or accept delivery of a quantity of hops which will cause the total quantity of hops owned, contracted for, possessed or in any other manner controlled by him to exceed the quantity which he used in the manufacture of malt beverages in 1943. Under this action, which is taken through an amendment to FDO 66, similar restrictions are imposed on brewers in so far as hop products are concerned.

Fluid Milk—A quota on sales of fluid milk and cream is placed on dealers in 112 areas where WFA directs that sales be limited to those of June 1943, which is estimated to have shown the highest consumption of fluid milk and cream of any month in history. The limitation is made to keep consumption within the present limits, as production for the coming year probably will be lower than in the past year.

Butter—The civilian supply of butter will be smaller in 1944, according to estimates and allocations announced by WFA. On a poundage basis, civilians will receive about 47,000,000 lb. less this year than last, while the supply for the armed forces is increased by about 120,000,000 lb.

WPB Orders

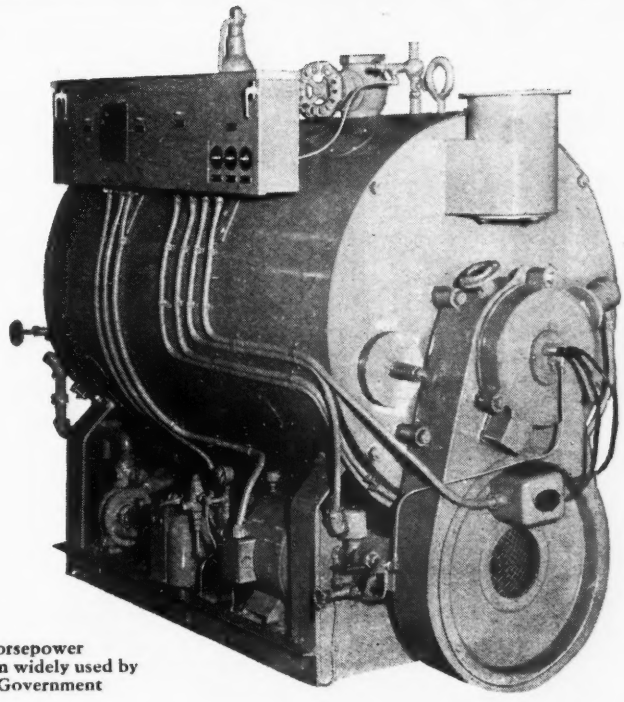
Beet Molasses—In a move to conserve beet molasses, because the current crop shortage is estimated at 35 percent, WPB has amended M-54 to prohibit the use of the beet product in mixed feed. The amendment will make available two million gallons of beet molasses for the production of yeast.

Pressure Canners—Authorization to produce up to a total of 400,000 pressure canners before July 1, provided that there be no interference with munitions manufacture, has been granted to six manufacturers, according to L-30-d, issued January 31. The canners may be made of aluminum and manufactured in two sizes, one holding seven and the other holding fourteen 1-qt. jars. Up to 300,000 of the smaller size and up to 100,000 of the larger size may be made.

Metal Cans—An interpretation of M-81 has been issued by WPB, explaining the method by which the 1944 metal can quotas can be calculated. The explanation applies where the quantity of glass used for packing products listed in the order is charged against tin quotas.

Honey—In a revision of M-63, honey, which for more than a year had been covered by the order, is not included among those commodities for which import licenses would be required. The shipping priority on honey will remain the same but the importation will be solely a matter of arrangement between the buyer, seller and transportation. Imported honey and imported sirups containing honey, however, do continue to be subject to the provisions of FDO 47, amendment 1 and 47.1, the same as domestic honey.

DOLLAR EFFICIENCY—work done per dollar spent—measures the value of a steam generator



30 horsepower Cyclotherm widely used by U. S. Government

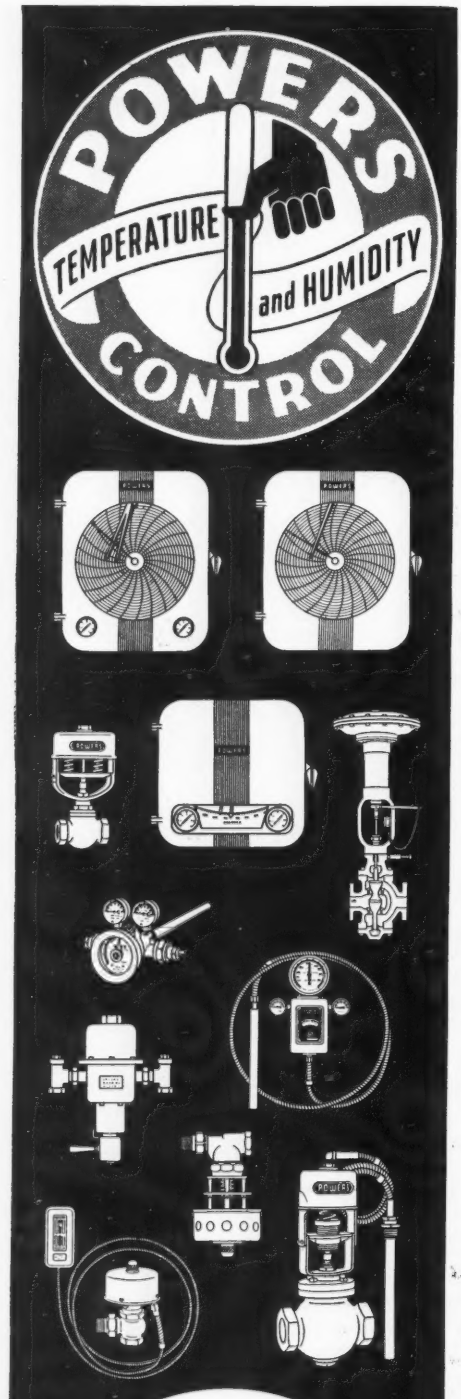
Cyclotherm is a self-contained, fully automatic steam generator for processing, power or heating that marks a new high in Dollar Efficiency.

Exclusive principles of combustion and operation assure high efficiency at low operating costs to owners of Cyclotherms. It is a steam generator built to make each unit of fuel produce more steam, to save hours of attendance, to deliver highly efficient, trouble-free service for years. Hundreds of them have proved their economy and dependability under the most difficult wartime operating conditions.

Cyclotherms are manufactured in units from 10 to 300 horsepower up. They are oil or gas fired. Some units are available now and deliveries are being made as rapidly as the press of Government orders permits. If you are planning replacements, our engineers will be glad to consult with you on any problem you may have. Write or call for additional information or any business or technical data you may wish.

CYCLOTHERM
STEAM GENERATOR

AMES IRON WORKS
OSWEGO . . NEW YORK . . BOX 101



When you want accurate and dependable automatic temperature or humidity control for Industrial Processes, Heating or Air Conditioning Systems, call in a Powers engineer. With over 50 years of experience and a very complete line of self-operating and air operated controls we are well equipped to fill your requirements.

Write for Circular 2520

2793 Greenview Ave., Chicago
Offices in 47 Cities—See your phone directory.

THE POWERS REGULATOR CO.

CAPITAL VIEWS

PATRIOTISM EFFECTIVE — Victory gardens and home canning, inspired by patriotism, or fear of shortage, were amazingly effective last year. Washington will urge similar and enlarged action in 1944. The results may be even greater than in 1943. Authorization has been given to produce 400,000 pressure cookers for home canning. If these are worked like the old ones were last year, the result will be even more significant for canned food. Washington believes that some of the present surpluses of canned vegetables which are easing off on rationing rules came from this source. Canners planning their sales campaigns for next winter must take these factors into account.

SUGAR FOR ALCOHOL—Molasses for manufacture of alcohol has been purchased in Cuba to the extent of 800,000 tons of contained fermentable sugar. Washington does not think that this will reduce sugar rations for the housewife or for the food industries. But it certainly will postpone the easing of sugar supply materially. Another factor is the continued production of alcoholic beverages in the Caribbean area for import into the United States. Sugar users may have to become vocal in order that too much sweetener may not go these other routes to the detriment of food manufacture.

CHEESE AND COFFEE—Some spokesmen about Washington who would like to support the cheese-making industry for its long-term good are worried. Information recently released by the coffee industry naturally increases their fears. Coffee men report that since rationing rules have been lifted the public has not returned to its old habit of coffee drinking. The cheese spokesmen are worried about this, and for another reason which seems even more important. Most of the cheese now available to the American housewife is certainly far from the best which the industry usually supplies. Mrs. Housewife is losing the habit of making cheese dishes because she is not able with the low-flavor material now available to get the best tasty result. There is valid reason to wonder whether this may not destroy the American family's taste for cheese. If it does there will be a tremendous job in the postwar period in the rebuilding of cheese demand. Lack of quality in any food is serious, even in wartime.

RESEARCH NOT PATENTABLE?—The results of systematic research are not invention? Such a conclusion seems indicated by a decision written by Mr. Thurman Arnold, one of the associate justices of U. S. Court of Appeals for the District of Columbia. The decision as written is of primary interest to Teletype Corp., but the phraseology of the opinion is so broad as apparently to condemn any tendency of the Patent Office to grant patents on the results of systematic organized industrial research. The report makes a distinction between patents of that sort and those which should be granted to individual inventors. It also attempts to restrict the use of patents on the ground that they create monopoly. One cannot escape the conclusion that Justice Arnold is continuing as a justice the campaign which made him so conspicuous as a prosecutor while heading the antitrust division of the Department of Justice. Many who comment on the decision wonder whether we are now going to have a whole new set of laws written from the bench instead of in Congress.

ADVICE ON FUEL—No food plant management needs to be told that fuel is really scarce. But some may not know that Uncle Sam is affording a service to aid industrial managements in fuel economy. Thousands of volunteer engineers have been enrolled under the U. S. Bureau of Mines program as a "National Fuel Efficiency Council". Any management that would like advice should communicate with the Bureau headquarters in Washington. Anything which will save fuel is important just now.

WOOD SUGAR STUDIES—Washington expects that a commercial plant will be built in Eugene, Ore., to make wood sugar from sawmill waste. The end-product will be alcohol. But the important new development will lie in the conversion of waste wood into fermentable sugar. This

BEFORE ADVERTISING A FOOD PRODUCT

Investigate our facilities for determining its Nutritive Values, especially its Vitamin Content. At the same time we may be able to suggest improvements in processing.

Look into the services available to food manufacturers in this modern, fully equipped and staffed laboratory. Armed with the scientific facts regarding your product, advertising and sales work will proceed based on a firmer foundation.

Write for the illustrated Brochure, detailing the work of our Laboratories. A copy is sent free on request.

FOOD RESEARCH LABORATORIES, INC.
48-14 Thirty-Third St., Long Island City, N.Y.
Over 20 years' service to industry

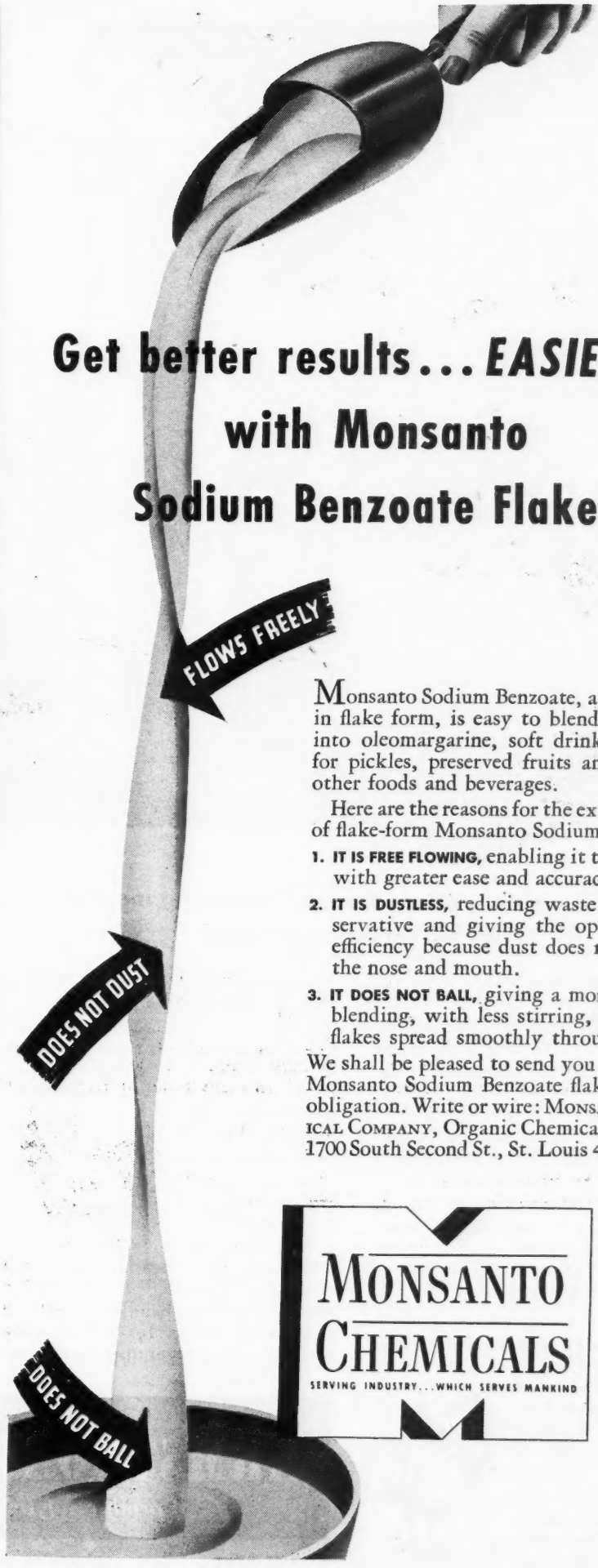
project, which is being encouraged by Washington, promises new information of value to the food industries.

PROMPT SETTLEMENTS – Perhaps most urgently needed at this time from Washington is a plan to permit prompt settlement of war contracts and the disposal of war surpluses. The food industries will be less affected, since food will continue in demand and contract termination is not yet a very important problem (except in food dehydration plants). The policies now being formulated on munitions and mineral raw materials will ultimately protect or pinch food executives when the end of their war service approaches. Immediate influence through proper political means for a decent constructive policy is therefore the selfish duty of the food industry, as well as others.

INDUSTRY TO BE HEARD–One of the most sweeping and comforting restrictions on the bureaucrats was issued in a signed statement by Donald Nelson of WPB the last day of January. His new order states: "No limitation or conservation order or amendment may be issued without prior consultation with an industry advisory committee if the change will result in a substantial alteration in the operations of that industry." Thus industry is assured that restrictive rulings from now on can be made only after industry has been heard. This will not prevent all bad rulings. But it will help a lot to guide the vast majority of well-intentioned, but not always well-informed, executives of WPB divisions, sections and units. The food industries would be glad if Marvin Jones would impose a comparable restriction on WFA executives.

SELLING STARTS AGAIN–It is noticeable that salesmen are again beginning to practice their art in industry. It is time that they did so. The war is not yet won. We do not yet have all of the industrial equipment and supplies that we would like to sell or buy. But we can hope for, and expect, the arrival of such happy days before very long. When they come it will be too late to start telling the ought-to-be customers about the wares or services then available. And busy industrial executives on the buying end must remember that they should set aside a bit of their time even now to think about their postwar purchases. There will be no sudden surplus of industrial goods. Nor will the postwar buying be properly a grab-the-first-thing-available. Intelligent industrial selling should be met with constructive postwar buying. The resulting bargain will be for the long-term good of the industry.

FOOD VS. FEED–To conserve beet molasses, which is 35 percent short, Uncle Sam has prohibited the use of this material in mixed feeds. The purpose is "to make some 2,000,000 gal. of beet molasses available for the production of yeast." Thus the food objective of yeast-making takes precedence over feed even when feed is scarce. Also it should be noted that some of the yeast may be dried to become a protein feed ingredient instead of merely a feed sweetener.



Get better results... *EASIER*... with Monsanto Sodium Benzoate Flakes

Monsanto Sodium Benzoate, a preservative in flake form, is easy to blend thoroughly into oleomargarine, soft drinks, solutions for pickles, preserved fruits and numerous other foods and beverages.

Here are the reasons for the extra efficiency of flake-form Monsanto Sodium Benzoate:

1. **IT IS FREE FLOWING,** enabling it to be applied with greater ease and accuracy.
2. **IT IS DUSTLESS,** reducing waste of the preservative and giving the operator more efficiency because dust does not get into the nose and mouth.
3. **IT DOES NOT BALL,** giving a more thorough blending, with less stirring, because the flakes spread smoothly through liquids.

We shall be pleased to send you a sample of Monsanto Sodium Benzoate flakes without obligation. Write or wire: MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second St., St. Louis 4, Missouri.

MONSANTO CHEMICALS
SERVING INDUSTRY...WHICH SERVES MANKIND

"Crusher Test" proves FOAMGLAS* is strong

Here's a moistureproof, fireproof insulating material with high crushing strength

Just how strong is Foamglas? This has been answered by tests made in Armstrong's Laboratories on this sensitive, accurate Baldwin-Southwark Universal Tester. When tested on all faces, Foamglas blocks have an average compressive strength of 150 pounds per sq. in. Thus, this new, low-temperature insulation can be erected without framing members to form self-sustaining walls and partitions in cold-room construction.

Proof against moisture is a second important feature of Armstrong's Foamglas. The material is composed of thousands of tiny cells—and each cell is completely isolated from adjoining cells by thin glass walls. Hence, neither moisture nor vapor can penetrate Foamglas—so it's just as efficient years later as the day it is erected.

Proof against fire. Since Foamglas is pure glass, it is absolutely fireproof. In many types of refrigerated construction—particularly in marine work—this is an extremely important requirement of the insulation.

Add them up—moistureproof, fireproof, and high structural strength, plus insulating efficiency and easy handling—and you have good reason for investigating this new, low-temperature insulation.

Write today for your free copy of the folder, "Armstrong's Foamglas," which gives complete physical data. Address Armstrong Cork Company, Building Materials Division, 3303 Concord St., Lancaster, Pennsylvania.

PHYSICAL PROPERTIES

Average crushing strength,	150 lbs. per sq. in.
Modulus of rupture	90 lbs. per sq. in.
Modulus of elasticity,	163,000 lbs. per sq. in.
Impact resistance	66 foot-pounds
Absorption (24 hr. immersion in water),	0.4% by volume, 2% by weight (all at surfaces)
Permeability	0
Capillarity	0
Volume change with moisture	0
Conductivity (K at 70° F.),	0.45 B.T.U. per hr. per sq. ft. per °F. per in.
Specific heat	.16-.19 per lb. per °F.
Coefficient of expansion	.0000046

* Trade-mark, Pittsburgh-Corning Corp.

ARMSTRONG'S FOAMGLAS

A product of Insulation Headquarters

CORKBOARD • MINERAL WOOL BOARD • CORK COVERING

MEN • JOBS • COMPANIES

INDUSTRY

Balch Flavor Co., Pittsburgh, Pa., processors of stabilizers and flavors for ice cream and dairy products, has taken over the stabilizer department of Puro Products Co., Chicago.

Canada Dry Ginger Ale, Inc., plans to construct ten new plants as a part of its postwar expansion program.

Carnation Co.'s research laboratories in Milwaukee, Wis., has added P. G. Miller and Donald Barber to its staff.

P. Duff & Sons, Inc., the 77-year-old Pittsburgh food company, has completed negotiations to join American Home Products Corp., continuing under the present management and personnel. The acquisition is subject to approval of the Securities and Exchange Commission. Purchase of the Pittsburgh firm is another step in the expansion of food operations by American Home Products.

Eardley Fish & Filleting Co., Seattle, Wash., has purchased Wilson Bros. mill site at Aberdeen, Wash. Construction of a fish house and filleting line at Aberdeen will begin immediately.

Kraft Cheese Co., Chicago, Ill., has bought the building and equipment of the Melrose, Minn., plant, of National Egg Dryers, Inc. After conversion and expansion, the plant will process powdered skim milk, buttermilk powder, butter, sweet cream and frozen cream, evaporated milk, condensed whole and skim milk and ice cream. The addition of the Melrose branch brings the total of diversified dairy product plants operated by Kraft in Minnesota to four.

C. W. COOK

General Foods Corp., New York, has promoted C. W. Cook, formerly chief engineer, to the newly created position of division manager of manufacturing and engineering for the plants of Birds Eye-Snider, Inc., and General Seafood Corp. L. J. Jordan succeeds Mr. Cook as chief engineer.

WILLIAM H. MARCUSSEN

HAROLD W. COMFORT

Formerly president of Borden's Farm Products Division for the past five years, William H. Marcussen becomes vice-president in charge of the fluid milk division, succeeding Harold W. Comfort, who has been promoted to executive vice-president of Borden Co. Mr. Comfort, who has directed the fluid milk division since 1937, will assist the president and George M. Waugh, Jr., in various executive capacities.

Litteral Canning Co. has been newly organized in Fayetteville, Ark., by J. W. Cain.

Loudon Packing Division of Standard Brands, Inc., has made arrangements to pack its food products at Pratt-Low Preserving Co., Santa Clara, Calif. The new operations will not interfere with expanded Pratt-Low canning activities except on tomatoes.

Morton Salt Co.'s Marysville, Mich., plant, one of its largest, recently was destroyed by fire, with damage estimated at $2,500,000. The plant had a capacity of 250,000 tons of salt a year.

National Mustard Manufacturers Association has been newly formed with a membership list of 30. Carl M. Plochman, of Plochman & Harrison, Chicago, has been elected president and Paul L. Dorn, Crown Food Products Co., Atlanta, Ga., becomes secretary-treasurer.

Sprague Warner-Kenny Corp., Baltimore and Chicago, has purchased the controlling stock interest in Western Grocer Co., of which Marshall Canning Co. is a wholly owned subsidiary. There will be no change of personnel or policy.

Sunnyside Packing Co., Sunnyside, Wash., has installed new equipment and re-arranged its packing lines to increase its 1943 production pack.

Swift & Co., as a means of further expanding its ice cream operation, has bought Bellamy Ice Cream Co., Hampton, Va. The transaction also included a large distribution plant in Norfolk. C. H. Smith has been elected manager.

United Milk Producers of New Jersey has acquired a milk plant at Irvington, N. J., and is operating it as a state-wide milk cooperative under the name of New Jersey Milk Producers Cooperative Association.

PERSONNEL

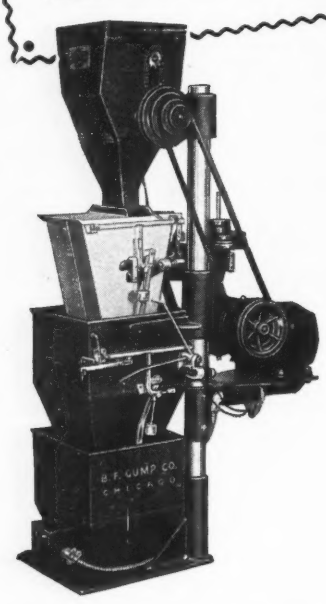
Carl C. Austin, Harry F. Jones and Oliver G. Willits have been elected vice-presidents of Campbell Soup Co., Camden, N. J.

Harry W. Block, formerly research chemist for Continental Foods, Inc., Hoboken, N. J., is now chief chemist with Kurtz Bros., Inc., Bridgeport, Pa.

J. O. Eastlack has been named president of Borden's Farm Products Division of Borden Co. and chairman of the company's Metropolitan New York fluid milk district, succeeding William H. Marcussen. He formerly held the position as vice-president in charge of production and quality control. Other appointments in the division are Francis R. Elliott as executive vice-president and Chester F. Buckley as a vice-president.

John Godston, formerly of Nulomoline Corp., New York, has opened an office in

Accurately Weigh Dehydrated Vegetables with this Efficient Automatic Machine!



EDTBAUER VEGETABLE WEIGHER

The new Model C-2 Edtbauer Vegetable Weigher is designed to weigh dehydrated beets, carrots, cabbage, onions and similar products automatically, accurately, efficiently. Equipped with timing mechanism for packaging or as weighing feeder for production line work. Available in four sizes—up to 25 pounds per discharge on materials weighing 30 or more pounds per cubic foot.

B. F. Gump Co

Established 1872

454 South Clinton Street, Chicago 7, Ill.

MAKERS OF: Equipment for Grinding, Sifting, Mixing, Feeding and Weighing of Dry Food Products.

New York, where he will give technical service to bakers and confectioners as a representative of food manufacturers, through Commodity Brokers, Inc.

Mary C. Harrigan, formerly food technologist at Friend Bros., Inc., Melrose, Mass., is now a chemist for the Federal Food and Drug Administration, at Boston.

William H. Hoodless has been elected vice-president in charge of development, design and research for National Sugar Refining Co., New York. Mr. Hoodless, who is director of Pennsylvania Sugar Co., a subsidiary, will give up his position to devote his time to the problems of present and postwar product and process development.

Ralph Hussong, formerly in charge of research for Sugar Creek Creamery Co., Danville, Ill., has been made head of dairy bacteriology at University of Illinois, succeeding M. J. Prucha, who has retired.

L. E. Laird, manager of the Holly Sugar Corp.'s plant at Worland, Wyo., for the past 14 years, recently has resigned his position, and has been succeeded by Henry Vallee, chief agriculturist for the corporation.

George R. Lawson, treasurer of Tillamook County Creamery Association, Tillamook, Ore., has been appointed general manager. He succeeds Carl Haberlach.

Morris Kirsch, Jr., president of Kirsch Beverages, New York, has been appointed president of New York State Bottlers' of Carbonated Beverages.

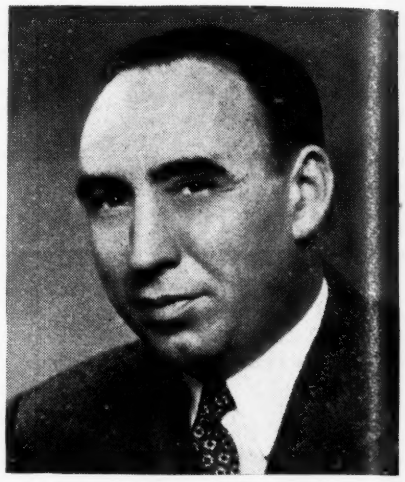
Ody H. Lamborn, president of Lamborn & Co., Inc., and an internationally known authority on sugar, has been elected president of New York Coffee & Sugar Exchange, Inc., New York, succeeding William B. Craig. Charles Slaughter was named vice-president.

Frank T. Lewis, formerly vice-president of Kingan & Co., Indianapolis, Ind., has been appointed president of Shefford Cheese Co., Green Bay, Wis.

John A. Miller, Montgomery, Ala., and Lewis A. Hirsch, Louisville, Ky., have been named president and vice-president, respectively, of National Pickle Packers Association, Chicago.

George F. Mitchell, manager of Maxwell House Tea Division of General Foods Corp., Brooklyn, N. Y., has been elected president of Tea Association of the United States, succeeding J. Graham Wright, president of Joseph Tetley & Co.

C. M. Peterson, former manager of Kraft Cheese Co.'s Albany, Minn., plant, becomes head of the firm's Northern Division, with headquarters at Minneapolis, Minn. C. E. Hanson, formerly executive of North American Creamery Co., Paynesville, Minn., was appointed plant manager of Kraft's new Melrose, Minn., branch.



DANIEL F. GERBER

Gerber Products Co., Freemont, Mich., and Oakland, Calif., manufacturer of baby foods, has named Daniel F. Gerber to the office of executive and first vice-president of the company. Earle L. Johnson has been elected vice-president and general sales manager and W. J. Hudson, vice-president and general manager of the Oakland plant.

IRVING C. REYNOLDS

Irving C. Reynolds, president of Franklin Creamery Corp., Toledo, Ohio, has been appointed chief of the Dairy Products, Fats and Oils Rationing Branch of the Office of Price Administration. Mr. Reynolds succeeds L. A. Baumann who has resigned to return to private industry.

Harry R. Schultz, formerly president and manager of Standard Soy Bean Mills, Centerville, Iowa, has been made manager of the soybean division of Pillsbury Flour Mills Co., Minneapolis, Minn.

A. E. Swanson has been elected president of Sun-Maid Raisin Growers of California, succeeding James M. Leslie. Clayton I. Chandler has been named vice-president.

Edward E. Wilkie, who has been with Libby, McNeill & Libby, Chicago, for 20 years, recently as vice-president, has been appointed a director of Libby. He also has charge of the company's milk and salmon divisions..

DEATHS

Charles A. **Fehlberg,** 66, former vice-president and a director of Narragansett Brewing Co., Inc., Providence, R. I., January 24, in Edgewood, R. I.

Robert A. **Hill,** for 10 years manager of Swift & Co.'s Atlanta, Ga., plant, recently, in Macon, Ga.

Rex **Rainier,** manager of Borden's Dairy & Ice Cream Co., Grand Rapids, Mich., recently, in Grand Rapids.

Benjamin O. **Sprague,** 65, president of Savannah Sugar Refining Corp., Savannah, Ga., January 31, in Savannah.

Edward J. **Stevens,** 73, manager of General Ice Cream Co., Worcester, Mass., recently, in Worcester.

Elbridge A. **Stuart,** 86-year-old founder of Carnation Milk Co. and nationally known livestock owner, recently, in Los Angeles, Calif.

Harold K. **Thomas,** 63, a member of Joseph A. Rich Co., Boston, and who has also been a member of New England Fish Exchange for 46 years, recently.

ASSOCIATED INDUSTRIES

Chisholm-Ryder Co., Inc., Niagara Falls, N. Y., manufacturer of food processing equipment, has purchased New Way Canning Machinery Co., Hanover, Pa. The Hanover plant will be known as New Way Division.

Cochrane Corp., Philadelphia, Pa., and Read Machinery Corp., Inc., York, Pa., have been presented the Army-Navy "E" pennant for outstanding war production. Alloy Steel Products Co., Inc., Linden, N. J., has been awarded a star on its "E," while Brown Instrument Co., Philadelphia, Pa., has been granted a renewal of its "E" for an additional period of six months.

Fred **Goat Co., Inc.,** Brooklyn, New York, has acquired the Champlain division of Interchemical Co., New York, with no change in organization. George N. Auerbacher will remain in charge as general manager and divisional vice-president.

Roger **Lueck,** director of research for American Can Co., New York, has transferred his headquarters from the company's Maywood, Ill., laboratory to the New York Office. He has been succeeded there by Bert S. Clark.

Mack-International Motor Truck Corp., Long Island City, N. Y., has appointed Henry Rowold as vice-president of the organization. He is also a committee member of the central truck tire rating board of OPA.

Vilter can REPLACE your worn-out REFRIGERATION EQUIPMENT!

ARMY E NAVY

BUY MORE WAR BONDS

★ Yes, there's no need now to suffer plant inefficiencies with worn-out, run-down refrigeration units and parts. Materials are available now for *immediate replacement*, for those units which cannot be economically repaired.

Superior Since 1867 VILTER Air Conditioning Refrigeration...

This is good news for you in the food industries who have been doing your best to make present equipment do the job. Get those "dead ducks" off the floor, spark up your processing and storage set-up with necessary replacements.

WRITE US FOR THE WELCOME DETAILS

VILTER MFG. COMPANY

2115 South First Street Milwaukee 7, Wisconsin

Offices in Principal Cities

COMPLETE REFRIGERATION FOR ALL INDUSTRIES

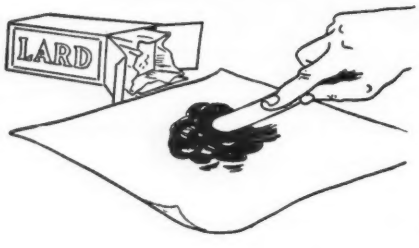
BOIL paper?

You can if it's Patapar

Patapar* Vegetable Parchment is the great wet-strength paper. It can be soaked in water indefinitely. BOIL it and it will remain firm and strong.

This unique characteristic of Patapar is solving tough problems every day. In the food field, for example, moist products that cannot be entrusted to ordinary wrappers are kept fresh and appetizing in Patapar. And manufacturers who process wrapped products at high moist temperatures are using Patapar with safety.

RESISTS GREASE, too



Patapar is proof against grease, fats and oils. Give it a good smearing and you'll see how it resists penetration. Products with extreme grease content are packaged in it and get utmost protection.

Ideal material for:

WRAPPERS for butter, meats, fish, cheese, poultry, shortening, ice cream, vegetables, dried fruits

CARTON AND BOX LINERS

BULK PACKAGING UNITS

MILK CAN GASKETS

MILK BOTTLE HOODS

PACKAGING COFFEE AND TEA

And many other uses

*Reg. U.S. Pat. Off.

Paterson Parchment Paper Company

Headquarters for Vegetable Parchment since 1885

Bristol, Pennsylvania

WEST COAST PLANT: 340 BRYANT STREET, SAN FRANCISCO 7, CALIFORNIA

BRANCH OFFICES: 120 BROADWAY, NEW YORK 5, N. Y. • 111 WEST WASHINGTON STREET, CHICAGO 2, ILL.

FOOD EQUIPMENT NEWS

Truck tire designed for cooler operation.

Truck Tire

B. F. Goodrich Co., Akron, Ohio, has brought out a new design and construction of the "Speedliner Silvertown" truck tire. The object of this new development is a tire that runs cooler. Reduced tread thickness at the shoulders and addition of new ventilating grooves in the shoulder blocks are the main changes in the construction that lessen operating heat, while other changes in design reduce the danger of sidewall cracking. The sidewall has been made thicker at the base of the grooves between the shoulder blocks, and the ornamental rib on the sidewall constructed shallower to provide better distribution of stresses.

Feedwater Regulator

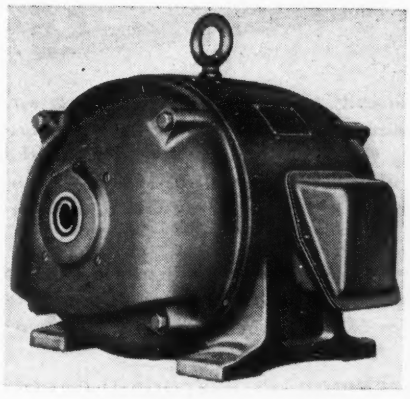
Combustion Control Corp., 77 Broadway, Cambridge 42, Mass., has brought out the "Fireye" feedwater control, series P156N. These are electronic devices for maintaining constant water levels in boilers automatically and for guarding against low water hazards.

As installed, the regulator determines the high and low levels at which the feedwater is turned on and off to maintain a constant water level. The regulator is designed to shut off the fuel supply immediately and sound an alarm when the water in the boiler drops below the low water safety point.

These feedwater controls are also available in types for automatic pump control only or for low level protection only. They are supplied as standard for boiler pressures up to 300 lb. and for operation from a supply of 150 or 230 volts a.c. 60 cycle electricity. The equipment will govern solenoid valves, small horsepower pump motors, or pump motor magnetic starters.

Splash Proof Motor

Century Electric Co., St. Louis 3, Mo., is now making Form J Splash Proof motors in sizes from 1½ to 15 hp., with two-way ventilation. The cooling air is drawn in through baffled openings in the bottom of the end brackets by a fan on each end of the rotor, blown through and around all parts of the motor, and out through louvered openings in the side of the frame below the centerline and at the bottom.



Splashproof motor with two-way ventilation.

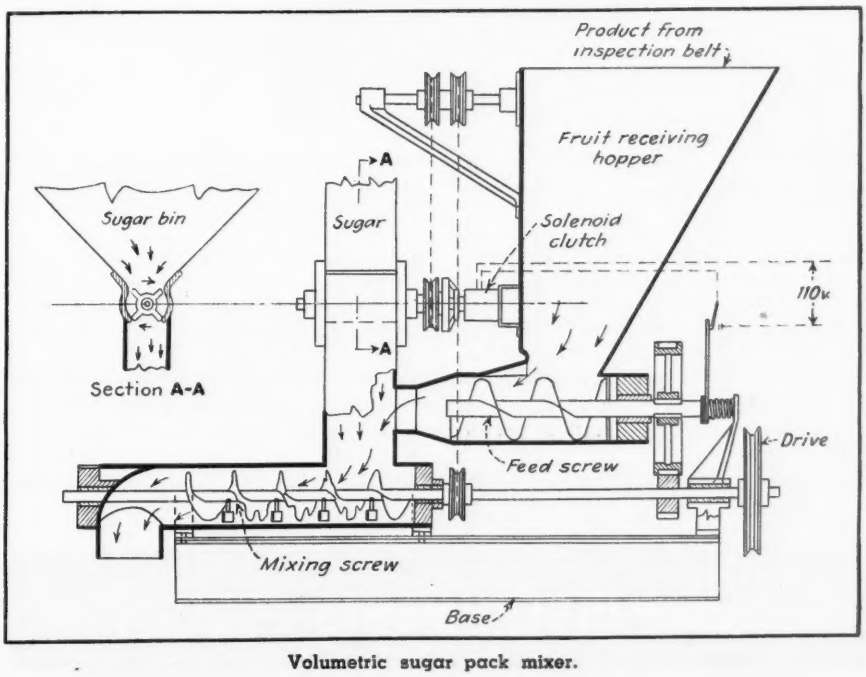
Edible Emulsifying Agent

Beacon Co., 97 Bickford St., Boston, Mass., has announced the availability of propylene laurate, a light amber, edible, non-hygroscopic oil. This product is completely dispersible in water, forming milky emulsions, the viscosity of which can be controlled. It is miscible with alcohol, glycerine, glycol, hydrocarbons, solvents and oils, possesses high boiling qualities, is nontoxic and practically odorless. Its makers suggest its use as an emulsifying agent in the manufacture of food, and as a base for shortening, among other applications.

Sugar Pack Mixer

Dixie Frosted Foods Co. has developed and applied for a patent on a "Volumetric Sugar Pack Mixer," and one of these machines is to be installed in the company's plant at Georgiana, Ala.

Referring to the accompanying drawing, berries are fed from the inspection belt into the machine hopper, from which they pass by gravity into a feed screw. The discharge end of this screw conveyor is reduced to form a slight neck or orifice of predetermined cross-sectional area. If the screw housing is kept full of fruit, and the screw is of positive displacement and operates at constant speed, an accurate, uniform flow is maintained. The pressure exerted by forcing the fruit through



Volumetric sugar pack mixer.

Save Time in VITAMIN A Determinations

...Workers have indicated the ultraviolet absorption to be a more reliable index of Vitamin A content than antimony trichloride reaction with its attendant complications.
—Wilkie: U. S. Food & Drug Admin.

with the Beckman Spectrophotometer

The Beckman Spectrophotometer has already proved itself to be the fastest, simplest, and most accurate method for Vitamin A determinations. And, because the Beckman Instrument covers not only the visible and near ultraviolet, *but the complete range of ultraviolet* down to 220 mmu—this is the *only* spectrophotometer capable of handling ALL types of modern vitamin determination and control work!

Step up the speed, accuracy, and convenience of *your* vitamin work with the BECKMAN Spectrophotometer—the one spectrophotometer with *full range* to cover all present day vitamin work as well as future developmeent in this field!

Important Features of the Beckman Spectrophotometer

▶ **Entirely Self-Contained:** The monochromator, light sources, phototubes, and electrical measuring circuit are all incorporated within the instrument to insure maximum convenience ruggedness, and accuracy.

▶ **Easy to Operate:** Measurements are quick and simple to make. Direct readings in both % Transmission and Density can be made *simultaneously*.

▶ **Remarkably Versatile:** Interchangeable light sources, interchangeable phototubes, a monochromator with full range (220 mmu in the ultraviolet to 1000 mmu in the infrared) enable the instrument to meet all the varying requirements of research and control work with no sacrifice in convenience or accuracy.

▶ **Highly Accurate:** Although unusually simple to operate and remarkably versatile, the instrument is extremely accurate over the full scale, even with low light intensities. Stray light effects are less than 1/10 of 1% over most of spectral range.

▶ **Ruggedly Built:** Optical parts are rigidly mounted in a massive heat-treated iron block, within a hermetically sealed metal case. All parts are designed for long life and sustained accuracy.

Send for complete information on the Beckman Spectrophotometer. Describe the application you have in mind and our experienced engineering staff will gladly make helpful suggestions on the use of this instrument in *your* work.

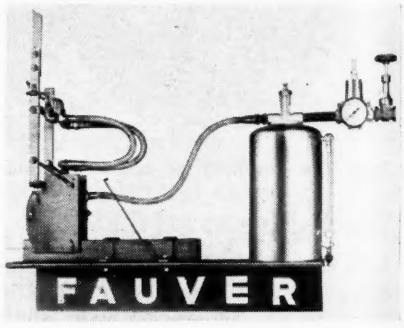
NATIONAL TECHNICAL LABORATORIES, South Pasadena, Calif.
Beckman Instrument Division

Beckman INSTRUMENTS SPEED PRODUCTION ...REDUCE WASTE

the restricted neck tends to force the screw backward against a spring, which energizes a solenoid clutch. This clutch starts the sugar measuring and feeding device in motion, discharging measured quantities of sugar along with the berries into the mixer. Thus both sugar and berries can be measured with fair accuracy in any desired proportion, and the action is continuous.

High-speed Conveyor Lubricator

DEVELOPED for the steel industry, but also suitable for lubrication of conveyors in the food field, including those in refrigerators and ovens, J. N. Fauver Co., Inc., Detroit 1, Mich., has brought out a new design of automatic



Lubricator for high-speed chain conveyors

conveyor lubricator. Designed to lubricate the link pins of chain conveyors, the lubricator automatically gives each pin a shot of lubricant as it passes. In some installations already in place, it lubricates as many as 192 link pins per minute, on conveyors moving at 160 ft. per minute.

Operation of the lubricator is caused when it is tripped by lugs on the chain sprocket wheel. Motive power is pneumatic, at a minimum air pressure of 40 lb. Spray nozzles have three-way adjustment.

Briquetting Press

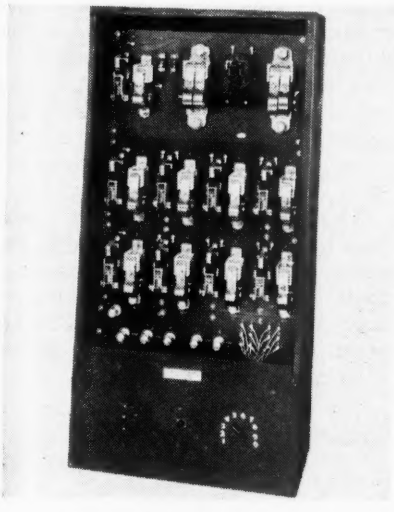
F. J. STOKES MACHINE CO., 5968 Tabor Road, Philadelphia, Pa., has announced a special model of the Stokes No. 280 Press, developed for handling a full range of granular and powdered dehydrated food products, and making round, rectangular or specially shaped briquets at rates as high as 40 per minute for cakes up to 4x4 in. (4 in. die-fill). On most operations this is run at maximum production rates of from 30 to 40 strokes per minute. Features of the new press include: variable speed drive, to permit the easy adjustment of machine speeds to the rates of flow of various materials being compressed, thus assuring maximum production at all times; low power re-

quirement—10 to 15 hp. only; toggle action, which gives a relatively slow, smooth squeeze in final closing and produces uniformly hard, dense briquets.

Operation is controlled by a combined clutch and brake, that immediately starts and stops the machine, even under full compression load. These presses are fully automatic in operation, self-contained and, if required, can be furnished to apply simultaneous pressure from both above and below up to full rated 100-ton capacity.

Magnetic Voltage Selector

ZENITH ELECTRIC CO., 152 West Walton St., Chicago 10, is making a magnetic voltage selector designed for greater precision and efficiency. It is arranged for transferring in steps from 2 to 40 volts. The arrangement is such that when transferring, the main contact opens before the secondary contact opens, and closes after the secondary contact is closed. This is said effectually to prevent arcing. The new unit embodies automatic main magnetic contacts and automatic main switch contacts for nine positions at 2½ volt intervals.



Magnetic voltage selector.

Control Instrument

BRISTOL CO., Waterbury 91, Conn., has announced the Model 431 "Pyromaster" self-balancing potentiometer. This instrument has a universal wall or flush mounting case that is deeper than the previous Model 440M and has an internal hinged panel on which are mounted pen and indicator drive mechanism and, in the case of electric controllers, the control contacts or proportioning slide wire. In the case of

Racks carry bread to wrappers.
Rigid arm makes handling easy
Ideas for Post-War PRODUCTION
Here are several American MonoRail installations which have proven successful in low cost handling. Any plans for postwar production should include such handling methods.
Regardless of the size or type of application, American MonoRail Engineers can help. Their specialized experience often uncovers hidden possibilities for simple systems that bring immediate returns. Consultation with these men is available without obligation. Write for copy of Bulletin C-1 showing a wide range of installations.
No bruised fruit on MonoRail
THE AMERICAN MONORAIL CO.
13125 Athens Avenue Cleveland 7, Ohio
Through each process without rehandling
Cooling in storage before labeling
Speedy order make-up on MonoRail

1200 LB.
Forkful of Spuds

SIGNAL CORPS PHOTO

. . . . A SMALL SNACK FOR TOWMOTOR!

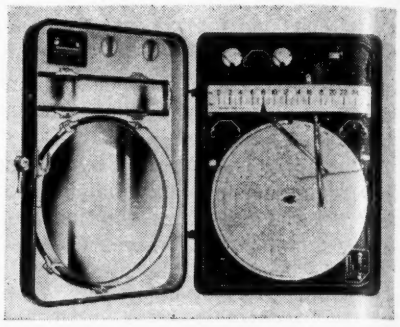
"Passing the spuds" twelve bags at a time is an easy chore for Towmotor Fork Lift Truck, because Towmotor can lift, move and stack loads weighing as much as 10,000 pounds. And that's only part of the efficient materials handling results possible with Towmotor . . . the one-man-gang!

One man and Towmotor can hustle big pay loads at speeds up to 880 feet a minute . . . spot them on a hair-line or stack them girder-high — up to 20 feet! This last feature often doubles storage space.

The Towmotor way means savings in time, space, manpower and money. Complete details are in the new Towmotor "Data File." For your free copy write Towmotor Corporation, 1222 E. 152nd Street, Cleveland 10, Ohio.

TOWMOTOR

THE 24-HOUR ONE-MAN-GANG



New model of self-balancing potentiometer control instruments.

air control, the complete new convertible type air operated control mechanism is mounted on this panel.

The maker states that the deeper case and inner panel permit any part of the instrument to be serviced or replaced without disturbing any other part. They also make it possible, in electric type controllers, to include the control relays in the instrument, thus avoiding the use of considerable external wiring.

Among the advantages claimed for the new model are a heavy duty pen drive motor that gives more torque for operating control contacts and other similar functions, especially under conditions of poor line voltage regulation. The indicating scale on the indicating-recording model has been changed to a wide horizontal band, in place of the rectangular dial type provided on Model 440 M.

This new instrument uses the same basic principle as previous models, providing a self-balancing round-chart recording potentiometer that has no continuously moving mechanical elements, is unaffected by vibration, and needs no lubrication.

Level Control

TRIMOUNT INSTRUMENT CO., 37 W. Van Buren St., Chicago 5, has brought out a level control utilizing electronic principles. It is claimed that this new control will maintain, or keep within desired limits, the level of any liquid or electrically conducting solid within an open or closed tank, bin, hopper or other container. It indicates the level by signals, or can be installed to operate solenoid or motor-driven valves, pumps, lights, bells, or other electrical devices.

The control is non-mechanical and has no moving parts. It also has no chemical or other effect on liquids or solids being controlled. It can be installed in evaporators, freezers, boilers, or other containers involving extreme temperatures

Various combinations of single and double electrode installations are available.

Coliform Control

(*Continued from page 89*)

gun) a full 10-minute contact. The solution is now drained out at the lowest points of the system. The fittings removed are then replaced after immersion in sterilizing solution. A 2-minute flow of warm water (120 deg. F.) introduced at the pasteurizer gate is used to "follow up" the sterilizer. This, too, is drained out.

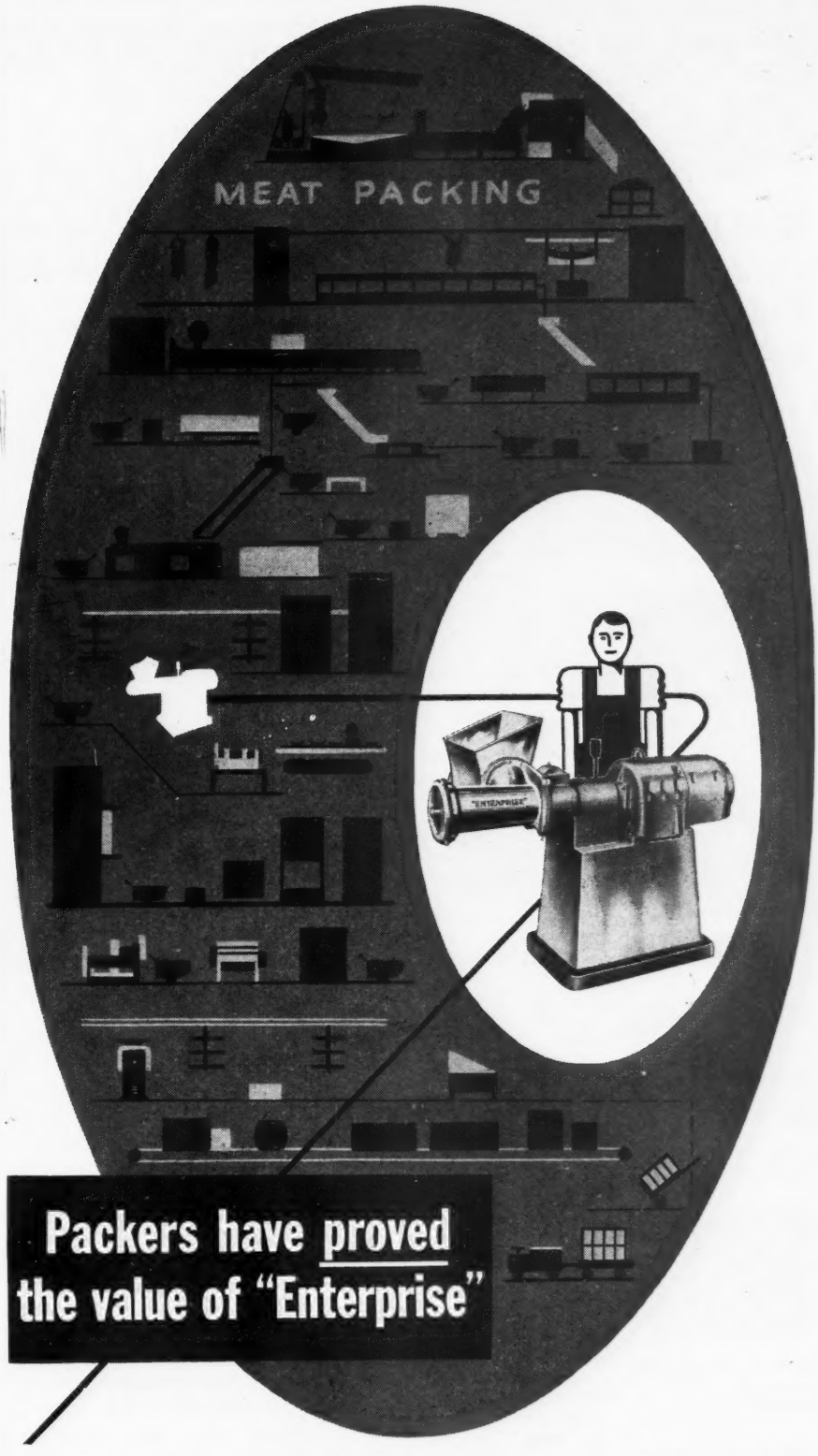
26. The contact of hypochlorites with the equipment should not be continued indefinitely—there is no point to "overnight soaking"—especially since the chlorine compounds are corrosive to metals. The final water rinse will prevent the first product processed from showing a "chlorine" flavor. It will also avoid the "cardboard" flavor which is stimulated by the use of hypochlorite on copper-alloy equipment.

27. Sterilizing solutions made from the normal hypochlorite concentrates show no "wetting" ability beyond that of the diluting water employed. Hypochlorite concentrates mixed with compounds to increase the wetting powers of the sterilizing solutions are commercially available. Hypochlorites cannot be mixed successfully with most wetting agents: their sterilizing ability is lost.

28. A few wetting agents have been developed[6, 7] which destroy bacteria rapidly and are not poisonous to humans. In addition to their extreme penetrating ability, these compounds are stable and noncorrosive to metals. Their employment greatly simplifies the problems developed by the hypochlorites' characteristics. One of them, the cationic quaternary ammonium compound sold as "Roccal" (Winthrop Chemical Co., Inc.) has been approved for food plant sterilization use by many health departments. It is used in the identical manner outlined for hypochlorites in paragraph No. 25.

Handling During Operation

29. The properly pasteurized product will not pick up any coliform organisms in its passage through the sterilized system. Contamination may occur at the end of the line, or if the system is broken. Containers must be coliform-free when they reach the bottle filler. The bottles coming from power washers are generally so, after the exposure to hot caustic solution and rinses with coliform-free water. Final rinsing with chemical sterilizers, provided in some models, is additional insurance. (Freshly washed bottles should be tested at intervals.) The area in which the bottle washer is located should be kept clean. Air currents are

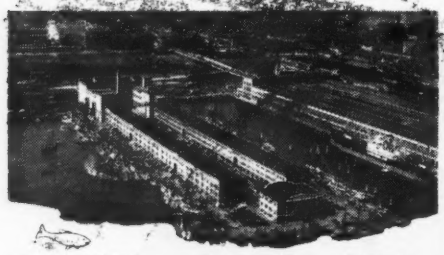


For clean shear cutting without mashing or tearing the material, "Enterprise" has proved *outstanding* —and not only for packers, but for confectioners, ice cream makers, catsup makers, soup makers, indeed nearly *all* types of food processors.

"Enterprise" offers other big advantages, too . . . adaptability to fast production lines, fully automatic operation, *plus lower installation, operating and maintenance costs.*

If you will let us know your specific reduction problem, we shall send you information on models best suited to your needs.

ENTERPRISE
MANUFACTURING CO. OF PA.
Philadelphia 33

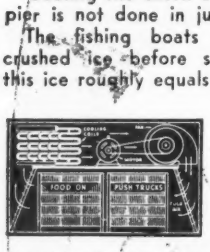


12 Million Pounds of Fish *-Sold without Rationing-* Handled Monthly at Boston Fish Pier with FRICK Refrigeration

Cooling the catch at the world's largest fish pier is not done in just one operation.

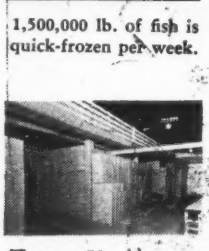
The fishing boats must be loaded with crushed ice before sailing. (The weight of this ice roughly equals seven-tenths the weight of fish brought in.)

From 50 to 80 per cent of the catch is quick-frozen, at a temperature of 30 deg. F. below zero. Standard Frick-freezing equipment is used.



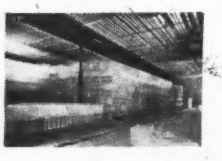
1,500,000 lb. of fish is quick-frozen per week.

The vast storage rooms, kept at zero, will hold 15 million pounds of seafood.



There are 70 cold storage rooms on the Pier, (some of great size.)

For icing railway cars, and the packages of fish in dealers' stalls, 110 more tons of ice are made per day.



250 Tons of ice are required per day.

Refrigerators, precoolers, research work, air conditioning, and special processes call for additional "cold."

Dealers, railway cars, trucks, and trawlers require ice.

All these services are supplied by the Commonwealth Ice and Cold Storage Co., at the head of the Pier, where Frick Refrigeration has been used exclusively ever since the great plant was built in 1914. Wm. D. Dunbar, Chief Engineer at the Commonwealth plant, says, "Frick Equipment handles the heaviest loads with dependability and economy."

Below: Some of the Frick Refrigerating Machines at the Commonwealth Plant.

FRICK & CO.

to be expected, and contaminated air will inoculate perfect containers if they are exposed to it. Conveyors carrying bottles from washers to fillers should be covered.

30. The dairy product is generally exposed to the air between the fillers and cappers. The rooms in which they are located should be kept in order—uncluttered—as well as perfectly clean. Drafts should be eliminated as much as possible. If it is necessary to handle containers between the washers, fillers and cappers, their tops and necks must not be touched. Bottle cases will contaminate workers' hands.

31. Rubber parts of filler valves, when cut, hardened or cracked, should be replaced. They cannot be sterilized adequately when defective. Coliforms protected in the cracks will be ready to contaminate the product when the container is filled and the rubber flexed. Cappers are the most serious source of system breakdowns if not fully cleaned every day. Capper parts and valves must not be handled during operation until the hands have been sterilized. Condensation which forms on bottler bowls will collect coliforms from the air, if not from handling. Such contaminated condensate is kept from reaching the external valve parts by the use of valve shields.

32. A bucket of sterilizing solution for the hands should be available near the fillers and cappers. Since sodium hypochlorite is very unstable, especially so when dairy products get into it, the type of sterilizing agent described in paragraph No. 28 is more suitable. A similar bucket of solution should be provided for use by the men who handle the processing equipment. Fittings which must be removed must not be replaced until they have been immersed in the sterilizing solution.

33. The addition of sugar to a dairy product increases the heat resistance of the coliforms. Flavored milk preparations, ice cream mixes, and so forth, are therefore pasteurized at 160 deg. F. for 30 minutes, or 180 deg. F. for 16 seconds. Temperatures and times should be watched carefully, since in these instances the absence of phosphatase units will not certify to an adequate heat treatment.

34. Whereas milk processing is continuous—bottling following directly after pasteurization—the handling of cream, ice cream and cultured products is not. After cooling, the latter type of dairy product is stored for an interval before packaging or further processing. The storage period will permit the growth of bacteria, as long as the product is not frozen solid. But coliforms cannot grow if they are not present. The storage containers must be protected against the entrance of coliforms by careful handling.

an independent source of

• PROCESS STEAM for SUMMER

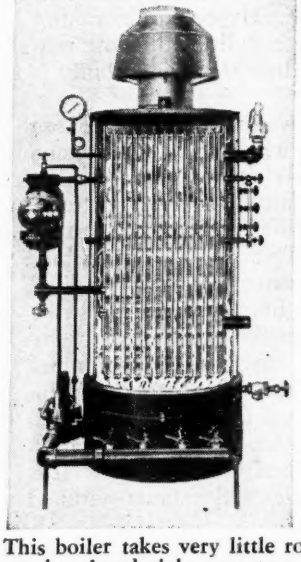
. . . always an ECONOMY!
. . . now a NECESSITY!

Forced to conserve precious fuel stocks, many plants and buildings will shut down their large central steam boilers this spring as soon as the heating season ends. Where steam is needed for processing, an independent local source will have to be provided. (Warning: There's no time to lose, with W.P.B. approval to be secured and boiler deliveries what they are!)

As a source of constant-pressure process steam, there's nothing more practical, more dependable, more efficient than a - -

KANE

Automatic Gas-fired STEAM BOILER



★

Cross-sectional view showing the construction of KANE gas-fired boilers.

★

This boiler takes very little room . . . and can be placed right next to process equipment it serves. Patented double-diaphragm gas control can be set to maintain any desired operating pressure up to 100 lbs. (Higher pressure boilers built to order.)

Illustration above shows special KANE construction. A jacket of steel and asbestos placed around, but not against, the boiler permits the hot gases of combustion to pass through spiral baffles *around* the shell as well as through the tubes, thus utilizing the shell for additional heating surface and increasing efficiency.

When making inquiry, please outline your requirements fully so we can reply intelligently.

MEARS-KANE-O'FELDT INC.
Manufacturers of Automatic Steam Boilers for over a third of a century.
1903-1915 EAST HAGERT STREET, PHILADELPHIA 25, PA.

35. The equipment which transports the cream, ice cream or cultured product from the storage containers through the end of the system must be rendered coliform-free before it is used. Caution! A new connection to a storage tank should be made only after complete washing and sterilizing of the exposed parts of the outlet valve.

36. Ice cream processing possesses a few places where coliform control requires special care. If "sanitary-head" (completely demountable) homogenizers are not used, loosen packing nuts to permit the washing and sterilizing solution to get at the packings. Color solutions should be sterilized by boiling and poured while hot into small bottles equipped with screw-cap closures. Single-service paper measuring cups should be used. Nuts should be roasted just before use or else sterilized by fumigation. Coliform-free fruits and flavors should be bought, or made so by pasteurization. Perfect coliform control of the mix is broken by the addition of contaminated materials at the freezer or fruit hopper. Packaging machine parts and novelty molds should be brushed thoroughly with alkaline detergent, then sterilized by immersion.

37. The accompanying flowsheets indicate treatments recommended.

Summary

1. Proper pasteurization destroys the coliforms present in a dairy product.

2. Coliform-free equipment is obtained and maintained most conveniently by the use of chemical sterilizers on clean equipment.

3. Coliform-free products can be prepared consistently only if the members of the operating personnel individually prevent recontamination.

References

1. W. Dorner, The Bacterial Flora of Aseptically Drawn Milk, *Technical Bulletin* 165, New York State Agricultural Experiment Station, Geneva, July, 1930.

2. H. Scharer, The Rapid Phosphatase Test, *Journal of Milk Technology*, vol. 1, 35–38, 1938.

3. "Standard Methods for the Examination of Dairy Products," American Public Health Association, pages 74–76, Eighth Edition, 1941.

4. L. W. Parr, Coliform Bacteria, *Bacteriological Reviews*, vol 3, 1–49, 1939.

5. "Methods and Standards for the Production of Certified Milk," American Association of Medical Milk Commissions, Inc., June, 1943.

6. F. M. Scales and Muriel Kemp, A New Group of Sterilizing Agents for the Food Industries, International Association of Milk Dealers *Bulletin* 19, April, 1941.

7. Z. Baker, R. W. Harrison and B. F. Miller, Action of Synthetic Detergents on the Metabolism of Bacteria, *Journal of Experimental Medicine*, vol. 73.

8. Z. Baker, R. W. Harrison and B. F. Miller, The Bactericidal Action of Synthetic Detergents, *Journal of Experimental Medicine*, vol. 74, 611–620, 1941.

NOW IS THE TIME TO DECIDE

WHAT IN THE

WORLD

YOU WANT!

• Whether your labeling requirements involve ink or iodine, catsup or cosmetics, liquors or lotions—whether it's continuous mass production you're after, limited output, frequent changes of container or label sizes and shapes, precise application of front labels, back labels, neck labels—or what have you—you will find the most efficient, economical labeling in the WORLD.

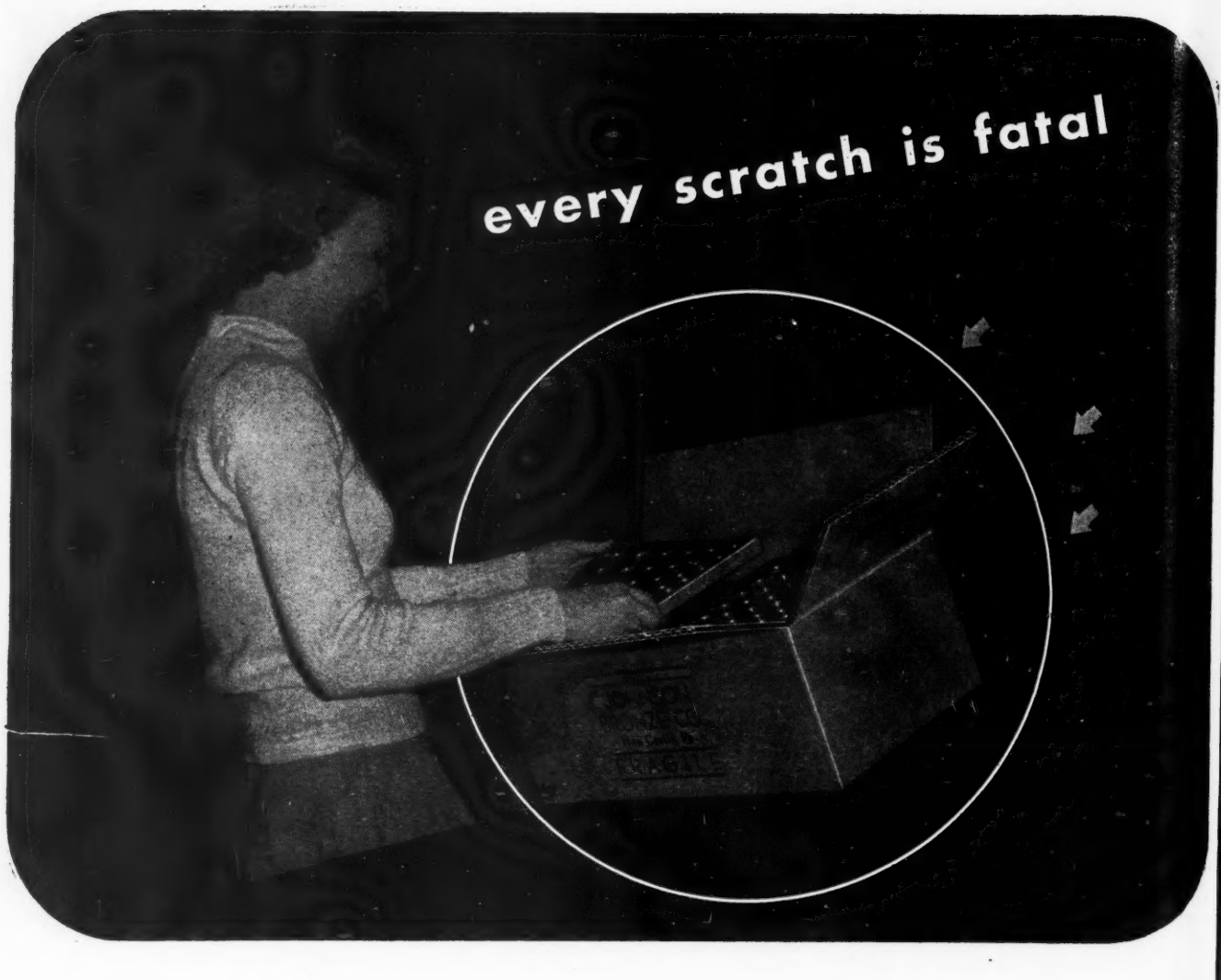
Tell us what you have in mind for the future and we'll see that you get all the information you need to plan wisely and well.

ECONOMIC MACHINERY COMPANY

Builders of World Automatic and Semi-Automatic Labelers for Every Purpose

Worcester, Massachusetts

NEW YORK PHILADELPHIA PITTSBURGH CHICAGO SAN FRANCISCO DENVER LOUISVILLE
SALT LAKE CITY EL PASO SEATTLE PORTLAND LONDON MONTREAL TORONTO WINNIPEG
SPOKANE VANCOUVER SYDNEY, AUSTRALIA WELLINGTON, N. Z. SAN JUAN, P. R.



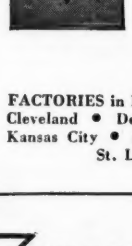
Scratches are fatal because they mean rejections! In the case of bronze bearings and bushings for important war-time requirements, scratches occurred when these items came in contact with each other during various phases of production and shipment. The answer? An H & D war-time packaging development that provides positive product protection throughout the entire production and shipping cycle.

H & D Package Engineers are not only devoting much time to war-time packaging but are also turning their attention to the packages of tomorrow.

Post-war packages must receive the same careful planning as the products entrusted to them for safe arrival. Damaged deliveries never create customer good-will. So plan *now* for your post-war packages, and plan to use corrugated boxes that both protect and promote your products. H & D's vast storehouse of war-time packaging information is available now for planning peacetime packaging. Write today.

Tells HOW to PACK War Materials in Corrugated Boxes

The chief requirement in packaging war goods is to get as much essential material to specified destinations in the fastest, safest, most economical way. "How to PACK WAR MATERIALS in Corrugated Boxes" tells how H & D boxes are effecting new shipping efficiencies and economies in important war packaging assignments. Get copies of this and other H & D Little Packaging Library booklets by writing The Hinde & Dauch Paper Company, Executive Offices, 4409 Decatur St., Sandusky, O.



• • •

FACTORIES in Baltimore • Boston • Buffalo • Chicago Cleveland • Detroit • Gloucester, N. J. • Hoboken Kansas City • Lenoir, N. C. • Montreal • Richmond St. Louis • Sandusky • Toronto

BUY WAR BONDS — YOUR SAFEST INVESTMENT

For postwar packaging . . better see **H&D HINDE & DAUCH**

AUTHORITY ON PACKAGING . . . CORRUGATED SHIPPING BOXES

CATALOGS & BULLETINS

FOOD PLANT EQUIPMENT

Circuit Breakers—A simplified means for determining the correct size air circuit breakers for all industrial substation applications has been made available in slide rule form or by monograph in Bulletin B6285 by Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

Dust Collectors—Features and construction specifications, together with the capacities and dimensions of three sizes of industrial type "CK" unit dust collectors, are covered in Bulletin No. 910 by Pangborn Corp., Hagerstown, Md.

Materials Handling Equipment—"Modern Materials Handling Machinery Applied to American Industry" is the title of a catalog illustrating typical applications of materials handling equipment such as self-loading power trucks, low and self-loading high-lift trucks and self-loading high-lift fork trucks; issued by Philadelphia Division, Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia, Pa.

Pumps—Open-impeller, balanced "Monobloc" centrifugal pumps, sizes 1½ to 2½, such as those used in canneries, packing plants, breweries and distilleries, are illustrated with diagrams and dimensional drawings, and capacity and dimensional charts are given, in Bulletin W-321-B7C, a 4-page pamphlet published by Worthington Pump & Machinery Corp., Harrison, N. J.

Rotary Kilns—"Automatic Temperature Control of Rotary Kilns" is the title of a 5-page reprint by A. A. Blackman, describing and illustrating the principles of operation of automatic temperature control as applied to large rotary kilns; published by Bristol Co., Waterbury 91, Conn.

Sheaves—Six photographs which demonstrate the put-on-take-off operation for "Magic-Grip" sheaves and a diagram illustrating how the sheave is locked to the shaft to provide smooth-running performance are given in 4-page Bulletin B6310 issued by Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

Sifters—Descriptions of heavy duty, low-head gyratory sifters designed for use in flour and cereal milling industries, drawings of 25 representative wire cloth mesh openings for 4 to 64 mesh and specification tables comparing mesh sizes for five kinds of sifting cloth are given in Bulletin B-6124A, issued by Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

Valves—"Air Furnace" globe, angle, gate and swing check malleable iron valves for 150-lb. steam pressure at temperatures up to 450 deg. F., and a comparison chart showing toughness and fracture-resisting properties of these valves, are given in a 6-page booklet put out by Jenkins Bros. 80 White St., New York 13.

Waste Disposal Equipment—Principles of operation, types and sizes, and numerous advantages of the Dorrco Vacuator developed primarily for the removal of grease, scum and light solid fractions from sewage and trade wastes prior to clarification are described in a 4-page pamphlet issued by Dorr Co., 570 Lexington Ave., New York 22.

PLANT SUPPLIES

Adhesives and Starch Products—"National Adhesives and Starch Products in Global Warfare," a 24-page pamphlet, reproducing in color a series of 20 posters available for display in industrial plants as a means of presenting essential end-use information to employees, is being distributed by National Starch Products, Inc., 270 Madison Ave., New York 16.

Fire-retardent Coatings—For the protection of interior building surfaces made of wood, wallboard, wood fiber, metal and other materials, Albi-Firepel "S," a liquid fire-retardent coating, is described in an 8-page catalog, "How to Repel Fire *Before* it Spreads"; issued by Albi Firepel Corp., 9 Park Place, New York 7.

Flexible Tubing—Specifications and technical data, as well as cross-sectional diagrams and photographs of Rex-Flex stainless steel flexible tubing, are given in 31-page illustrated Catalog SS-44, by Chicago Metal Hose Corp., Maywood, Ill.

Flavors—A new 12-page price list of essential oils, citrus concentrates, aromatic chemicals, tinctures and other products has been issued by Fritzsche Brothers, Inc., 76 9th Ave., New York.

Metal Hose and Couplings—Catalog G-42, a 38-page publication, giving construction features, specifications and sizes, pictures and typical applications of flexible metal hose and couplings used to carry liquids, gases and chemicals, has been issued by Chicago Metal Hose Corp., Maywood, Ill.

Wire Cloth—A pocket-size, 96-page booklet, "Industrial Wire Cloth, Engineering Data and Price List," explaining the different types of weaves available in wire cloth, metals and alloys, and listing in table form complete data on wire sizes, gages, standard weights and prices, has been published by C. O. Jelliff Mfg. Corp., Southport, Conn.

CONTROL EQUIPMENT

Electronic Control—The fundamental principles of electronic tubes and their operation, and the functions of eight of the more widely used industrial type tubes are described, in addition to illustrations of many practical applications of electronic control in processing and in photoelectric installations, in 12-page GEA-4126, issued by General Electric Co., Schenectady, N. Y.

pH and Chlorine Control—The application of pH and chlorine control in 31 different fields, such as boiler water, brewing, refrigerating brines, sugar and other operations, are discussed, including descriptions of Taylor slide comparators for general purposes, in an 83-page handbook and catalog, 6th edition, by W. A. Taylor & Co., 7300 York Road, Baltimore, Md.

Pyrometers—Photographs and specifications of pyrometers with high-speed photoelectric action, as well as of thermometers, recording potentiometers, recorders, indicators, recording controllers and other control equipment, are contained in 38-page Catalog No. 1101H issued by C. J. Tagliabue Mfg. Co., Park & Nostrand Aves., Brooklyn 5, New York.

MISCELLANEOUS

Decalcomanias—Published in file folder form for product engineers, designers and manufacturers, a check chart showing how to select and specify the right decalcomania nameplate for 16 different types of surfaces, and describing application methods, types and uses, has been issued by Meyercord Co., Dept. RT, 5323 W. Lake St., Chicago 44.

Maintenance—Designed to meet the demand for practical information on methods for removing hard water scale and rust deposits from water-cooled, steam-jacketed and water-circulating equipment, the use of Oakite Compound No. 32, an acid-type, scale dissolving material, is explained in a 28-page Oakite descaling manual issued by Oakite Products, Inc., 26 G Thames St., New York 6.

Truck Decorations—So that truck owners can obtain the maximum utilization of the advertising space on their motor truck fleets, illustrations of well-decorated truck bodies, ranging from delivery units to cross-country vans and tank trucks, and skeleton outline diagrams of many body types for experimental lettering and designing are found in a catalog put out by Meyercord Co., Dept RR, 5323 W. Lake St., Chicago 44.

BOOKS

Brining Vegetables

PRESERVATION OF VEGETABLES BY SALTING OR BRINING. Published by the U. S. Department of Agriculture, as Farmer's Bulletin No. 1932, 1943. 12 pages; 6x9¼ in.; paper. Price, 5 cents; for sale by Superintendent of Documents, Washington, D. C.

Although this bulletin was prepared for the home preservation of vegetables, all instructions may be adapted to large-scale commercial use by changing the amounts, keeping the same proportions of product and preservative. The bulletin tells how to preserve vegetables by dry salting and by brining, discusses the equipment and supplies needed and outlines the precautions that must be observed.

Feeding Europe

FOOD FOR EUROPE AFTER VICTORY. Published by National Planning Association, 800 21st. St., N. W., Washington, D. C., 1944. 43 pages; 5¼x7½ in.; paper. Price, 25 cents.

It has been said that there can be no hungry peace—that as soon as the shooting stops adequate supplies of food will have to be made available to the liberated peoples if the benefits of peace are to be enduring. With that in mind, the National Planning Association made a survey of the world's food situation. On the basis of this survey it has made recommendations as to the amounts of various foods which must be supplied to Europe after victory and what procedures must be followed in seeing that the people get enough to eat to maintain health.

The value of this report, which was digested in the February issue of FOOD INDUSTRIES (page 73), lies in its information on postwar food economics. This information can be used as a guide in the postwar planning of food processors.

Milk Marketing

EFFICIENCY OF MILK MARKETING IN CONNECTICUT. Published by the Department of Agricultural Economics, University of Connecticut, Storrs, Conn., 1942 to 1943. Seven pamphlets, totaling 329 pages; 6x9 in.; paper. Free.

In a series of seven pamphlets, the much discussed overall efficiency, or lack of efficiency, in the distribution of milk—not by companies but by the industry as a whole—is analyzed in detail. The pamphlets are based upon studies of the various operations involved in the movement of milk from the producer to the consumer. Though made in the state of Connecticut, the findings will apply more or less generally throughout the country, at least in some degree.

The studies were made to determine the magnitude of the savings that would result from more efficient milk marketing. The studies attempt to devise methods of performing each operation as efficiently as possible. The costs involved in the reorganized operation are then computed and compared with the costs incurred under the existing system. The findings are, to put it mildly, interesting. And since the management of dairy companies may be called upon by the people and their politicians to justify the customary methods of milk distribution, it might be well for them to study these reports.

The seven bulletins are as follows:

(1) Supply and Price Interrelationships for Fluid Milk Markets. (2) The Transportation of Milk. (3) Economics in the Assembly of Milk. (4) Retail Distribution of Milk by Producers. (5) Economics and Biology of Alternate-Day Milk Delivery. (6) Truck Costs and Labor Requirements on Milk Delivery Routes. (7) Milk Delivery in Rural Connecticut.

Food Biochemistry

ANNUAL REVIEW OF BIOCHEMISTRY. James Murray Luck, Editor. Published by Annual Reviews, Inc., Stanford University P. O., Calif. 660 pages; 6½x9¼ in.; cloth. Price, $5.

Of the 24 scientific papers contained in this twelfth volume of the "Review," more than half are of interest to food technologists. Being written by men of science, the papers are strictly technical in their treatment of their subjects.

Among the many papers that food technologists may find of interest are these:

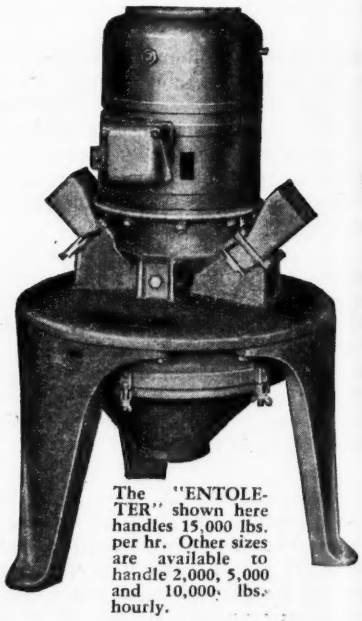
Biological Oxidations and Reductions, F. Lipmann; Proteolytic Enzymes, R. M. Herriott; The Chemistry of the Proteins and Amino Acids, L. F. Hewitt, R. A. Kekwick and A. S. McFarlane; The Chemistry and Metabolism of the Compounds of Sulphur, J. C. Andrews; Carbohydrate Metabolism, H. J. Deuel, Jr.; Fat Metabolism, G. O. Burr and R. H. Barnes; The Metabolism of Proteins and Amino Acids, H. Borsook and J. W. Dubnoff; The Chemistry of Carbohydrates, H. S. Isbell; Mineral Nutrition, L. A. Maynard and J. K. Loosli; Water Soluble Vitamins, R. J. Williams; Fat-Soluble Vitamins, K. Hickman; Nutrition, 1941 and 1942, C. S. Langford and H. C. Sherman; Mineral Nutrition of Plants, D. I. Arnon; The Electron Microscope in Biology, L. Marton; and Microchemistry, A. A. Benedetti-Pichler.

MORE— ABOUT THE ENTOLETER
INFESTATION DESTROYER
REG. U.S. PAT. OFF.

The "ENTOLETER" is the new *positive* method of insect control for food plants and flour mills. It completely destroys insect *eggs* and *other forms of infestation.* It thus serves most effectively to protect the high quality of food products . . . stops waste of vital food materials . . . and helps to solve the returned goods problem.

Independent tests, supported by actual plant performance records, show that the "ENTOLETER" is 100% effective in destroying infestation in flour, cereals, spices, powdered and similar free-flowing dry materials.

Approximately 3 ft. high by 2 ft. in diameter, "ENTOLETERS" are easily installed and inexpensive to operate. ENTOLETER DIVISION, The Safety Car Heating & Lighting Company, Inc., 230 Park Avenue. New York 17, N. Y.



The "ENTOLETER" shown here handles 15,000 lbs. per hr. Other sizes are available to handle 2,000, 5,000 and 10,000 lbs. hourly.

ENTOLETER
INFESTATION DESTROYER

BELOW ARE A FEW OF THE MANY PRODUCTS MADE BY FOOD PROCESSORS WHO SAFEGUARD THEIR HIGH QUALITY STANDARDS BY USING "ENTOLETERS"

RESULTS PROVE IT PAYS TO "ENTOLETE"

ENTOLETER DIVISION, The Safety Car Heating & Lighting Company, Inc., 230 Park Avenue, New York 17, N. Y.

"ENTOLETERS" are entirely mechanical in their action. No heat or chemicals are used. Operation is continuous and treatment does not harm the product. They are simple and inexpensive to maintain. Free reports of independent tests sent promptly on request.

ENTOLETER
INFESTATION DESTROYER
REG. U. S. PAT. OFF.

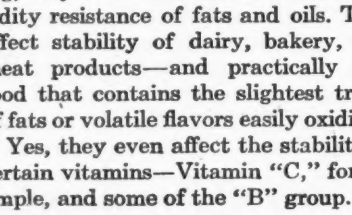
CONTINUOUS DESTRUCTION OF ALL INSECT LIFE

The Bad Boys Are on the Spot

IN DEMOCRATIC countries, police departments nab "bad actors" and keep them out of circulation. In food processing, we also encounter "bad actors"—elements and conditions that rob products of freshness, turn them rancid, destroy their flavor. But food technologists are already on their trail. They know, for example, that they must protect food products from irradiation by light . . . exclude oxygen or excessive humidity . . . guard against insect infestation.

Recent research shows that copper and iron, even in minute traces, are "bad actors." In the manufacture of shortening, they are eliminated to increase rancidity resistance of fats and oils. They affect stability of dairy, bakery, and meat products—and practically any food that contains the slightest traces of fats or volatile flavors easily oxidized.

Yes, they even affect the stability of certain vitamins—Vitamin "C," for example, and some of the "B" group.



We have reduced the copper and iron in Diamond Crystal Salt until today they represent less than 1 part per million. Salt products in general, however, may contain significant amounts of both copper and iron.

NEED HELP? HERE IT IS!

Why not check up on the salt you are now using? And if you would like our help in keeping the "bad actors," copper and iron, down to a minimum in your plant, drop a note to our Director of Technical Service, Diamond Crystal, Dept. J-5, St. Clair, Michigan.

DIAMOND CRYSTAL
ALBERGER PROCESS **SALT**

PATENTS

Cheese Coated With Petroleum Wax Containing High Fatty Acid and Propionic Acid to Inhibit Mold Growth—James D. Ingle, to Industrial Patents Corp., Chicago, Ill. No. 2,336,358. Dec. 7, 1943.

Milk and Similar Liquids Dried by Applying Film on Surfaces of Heated Rolls, Adding Finely Divided Dry Solids and Subsequently Removing Film and Solids From Heated Surface—Arthur C. Beardslee, Arcade, N. Y., to Borden Co., New York, N. Y. No. 2,336,461. Dec. 14, 1943.

Frozen Foods and Like Packaged in Preset Pressure Can—Rosario Lo Vico, Astoria, Long Island, N. Y. No. 2,336,490. Dec. 14, 1943.

Raw Sweet Whey Acidified by Mineral Acid, Adjusted to Neutrality and Heated to Between 100 Deg. and 180 Deg. F. Preparatory to Concentrating For Use in Bread Without Causing Binding in Bread Dough—David D. Peebles, Berkeley, Calif., to Golden State Co., Ltd., San Francisco, Calif. No. 2,336,634. Dec. 14, 1943.

Frozen Confections Held in Relatively Flat Deivce Having Plurality of Supports and Coated on Mass-production Basis—Frank Sportolari, Pittsburgh, Pa. No. 2,336,649. Dec. 14, 1943.

Discoloration of Freshly Cut Fruit Inhibited by Treatment With Aqueous Solution of Thioamide and Subjection to Freezing Temperature — Frank Earl Denny, Yonkers, N. Y., to Boyce Thompson Institute for Plant Research, Inc., Yonkers, N. Y. No. 2,336,928. Dec. 14, 1943.

Animal and Vegetable Foods Heated From Approximately 100 Deg. C. to Maximum of 120 Deg. C. and Subsequently Cooled to 100 Deg. C. at Rate to Give Same Results as if Heated to 190 Deg. C. for One Second—Arthur L. Davis, Knoxville, Tenn. No. 2,337,034. Dec. 21, 1943.

Free Fatty Acid Content of Animal and Vegetable Oils Neutralized Without Substantial Saponification by Use of Rotary-disk Mixing Device—Irvin K. Giles, Cranford, N. J., Mead Cornell, Cleveland, Ohio, and William Kelley, Los Angeles, Calif., to Lummus Co., New York, N. Y. No. 2,337,041. Dec. 21, 1943.

Poultry Plucked by Mechanical Means—Gordon W. Johnson, Overland Park, Kan. No. 2,337,201. Dec. 21, 1943.

Juice Extracted From Citrus Fruit by Pressure Under Nonoxidizing Conditions Without Rupturing Peel—Ronald M. McKinnis, to McKinnis Foods, Winter Haven, Fla. No. 2,337,261. Dec. 21, 1943.

Hams Mechanically Pressed Into Desired Shape Preparatory to Packaging—John Opie, Chicago Ill. No. 2,337,406. Dec. 21, 1943.

Dough Sheeted and Rolled by Mechanical Means—John Buechek, Kokomo, Ind., one-half to Uz McMurtrie, Indianapolis, Ind. No. 2,337,539. Dec. 28, 1943.

Food Stabilizing Agent With Concentrated Active Gelatinizing Principle Prepared From Sea Moss—Albert A. Lund, Port Washington, N. Y., to Jacques Wolf & Co., Passaic, N. J. No. 2,337,562. Dec. 28, 1943.

Cane Molasses Freed From Suspended Impurities by Diluting, Adjusting of pH, Heating Under Pressure With Addition of Hot Water, Mixing With Air for About 30 Minutes Preparatory to Settling for From 10 to 12 Hours and Drawing off of Molasses Layer—William H. Buhrig, Mount Vernon, N. Y., and Henry M. Harff, Wilmette, Ill., to Standard Brands, Inc., New York, N. Y. No. 2,337,641. Dec. 28, 1943.

Meat for Freezer Storage Glazed With Water Preparatory to Covering With Resistant Impervious Wax Coating—Leon L. Cadwell, to Industrial Patents Corp., Chicago, Ill. No. 2,337,645. Dec. 28, 1943.

Meat, Poultry, Fruits and Vegetables Coated for Storage by Composition Containing High Melting Amorphous Wax as Major Ingredient and "Pliolite" (Rubber-base Coating) as Minor Ingredient—Carl H. Koonz and James D. Ingle, to Industrial Patents Corp., Chicago, Ill. No. 2,337,666. Dec. 28, 1943.

Starch Saccharified in Continuous Manner — Alexander Sergeevitch Sipyaguin and Sholom Oscarovitch Shoemakher, Moscow, U.S.S.R. No. 2,337,688. Dec. 28, 1943.

Milk and Similar Liquid Packaged in Rectangular Carton With Pouring Spout Made Part of Scored Sealing Flap—Samuel H. Berch, Beverly Hills, Calif., to Flexible Container Corp., Los Angeles, Calif. No. 2,337,730. Dec. 28, 1943.

Evaporated Milk and Similar Canned Foods Agitated During Heat Treatment by Passage Through Unit With Helical Path of Travel—Albert R. Thompson, Los Gatos, Calif., to Food Machinery Corp., San Jose, Calif. No. 2,337,784. Dec. 28, 1943.

Dextrose-containing Hydrolyzed Starch Liquors Treated With Tannin, Phosphoric Acid, Alkaline Earth and Amylaceous Material and Heated to 175 Deg. F. for Removal of Undesirable Constituents in Manufacture of Dextrose—Reynold P. Jurgensen and Robert V. MacAllister, to Clinton Co., Clinton, Iowa. No. 2,337,852. Dec. 28, 1943.

Dextrose Containing Hydrolyzed Starch Liquors Treated with Tannin for Removal of Metals and Nitrogenous Matter, With Phosphoric Acid to Combine With Metals, With Calcium or Magnesium Hydroxide to Neutralize Acidity and Heated to 175 Deg. F. With Subsequent Separation of Precipitated Floc—Reynold P. Jurgensen and Robert V. MacAllister, to Clinton Co., Clinton, Iowa. No. 2,337,853. Dec. 28, 1943.

Rennet Extracted From Calves' Stomachs by Use of Aqueous Salt Solution of Ammonium, Alkali Metals and Alkaline Earth Metals With Concentration Between 3 and 10 Percent at pH Between 4.6 and 7.0 With Adjustment to pH 3.6 With Acid to Form Precipitate—Basil Duperier Thornley and Stanley Hilton, Wilmslow, England, to Benger's Ltd., Holmes Chapel, Cheshire, England. No. 2,337,947. Dec. 28, 1943.

Foods Packaged in Container Fitted With Closure That Permits Inverting of Filled Container in Steam Compartment and Injection of Steam Into Container for Sterilization and Sealing While Under Steam Pressure—John Mills, Winter Haven, Fla., and Charles W. Lang, Haddonfield, N. J., to Continental Can Co., Inc., New York, N. Y. No. 2,338,003. Dec. 28, 1943.

Fruit and Vegetable Juices Pasteurized in Continuous Manner—Charles E. Kerr, Hoopeston, Ill., to Food Machinery Corp., San Jose, Calif. No. 2,338,040. Dec. 28, 1943.

Salad Dressing Made to Contain Waxy Starch—Ben F. Buchanan, Leonia, N. J., and Richard C. Drury, Skokie, Ill., to American Maize-Products Co. No. 2,338,083. Jan. 4, 1944.

Head Space of Beverage-filled Containers Freed From Air by Foam Resulting From Gaseous Fluid Jetted Into Head Space Under Pressure—Bernard J. Gartland, Philadelphia, Pa., to Crown Cork & Seal Co., Inc., Baltimore, Md. No. 2,338,108. Jan. 4, 1944.

Corn Protein Used as Base in Printing Ink—Harry M. Weber, Chicago, Ill., to American Maize-Products Co., New York, N. Y. No. 2,338,151. Jan. 4, 1944.

Shredded Coconut Made to Contain 5 Percent of Propylene Glycol or Butylene Glycol to Retain a 5 to 15 Percent Moisture Content—Charles W. Kaufman, Hasbrouck Heights, N. J., to General Foods Corp., New York, N. Y. No. 2,338,184. Jan. 4, 1944.

Cottonseed Oil Given Resistance to Oxidative Deterioration by Incorporation of Nonpathogenic Bacteria — Sol Shappirio,

Washington, D. C. No. 2,338,207. Jan. 4, 1944.

Fermenters for Carbohydrate Mashes Sterilized by Treatment With Superheated Steam in Presence of Atmospheric Air and Held in Sterile Condition by Filling With Sterile Air as Steam Condenses During Cooling—Benjamin Clark Boeckeler, New York, N. Y., and Marcel J. P. Bogart, Teaneck, N. J., to Lummus Co., New York, N. Y. Nos. 2,338,227 and 2,338,228. Jan. 4, 1944.

Overrun in Ice Cream Put Under Mechanical Control by Use of Thermostatic Expansion Valve—James T. Smith and Alexander L. Reiter, Chicago, Ill., to Mills Novelty Co., Chicago, Ill. No. 2,338,362. Jan. 4, 1944.

Roasted Cocoa Bean Particles Recovered From Mixture With Cocoa Beans by Flotation in 2½ Percent Sodium Chloride Solution—Josef Drenker, Cologne, Germany, to Alien Property Custodian. No. 2,338,376. Jan. 4, 1944.

Edible Animal Gelatine Treated With Papain or Bromelin to Destroy Jelling Properties and Give Colorless, Completely Water Soluble, Palatable Solid Nutrient—Thomas B. Downey, Haddonfield, and Henry E. Williams, Mullica Mill, N. J., to Kind and Knox Gelatine Co., Camden, N. J., and Charles B. Knox Gelatine Co., Johnstown, N. Y. No. 2,338,415. Jan. 4, 1944.

Starch Made Soluble By Mixing With Solid Sodium Carbonate and Treating With Gaseous Chlorine—Meindert Danius Rozenbrock, Delden, Netherlands, to Alien Property Custodian. No. 2,338,457. Jan. 4, 1944.

Cooked Cereal Spread in Two Superimposed Strips, Mechanically Scored to Form Individual Units and Subjected to High Temperatures to Cause Puffing—Lamar Kishlar, Webster Groves, Clifton A. Cobb, University City, and Frank James, Normandy, Mo., to Ralston Purina Co., St. Louis, Mo. No. 2,338,588. Jan. 4, 1944.

Coffee Extract Made to Retain Original Taste, Flavor, Aroma and Clearness—Mark Weisberg, Providence, and Louis Corman, Cranston, R. I., to Mark Weisberg. No. 2,338,608. Jan. 4, 1944.

Dairy Equipment Freed From Mineral, Protein, and Fat Films by Treatment With Cleaner Containing Organic Acids—Milton E. Parker, Chicago, Ill., and Paul W. Bonewitz, Burlington, Iowa, to The Rex Co., Burlington, Ia. Nos. 2,338,688 and 2,338,689. Jan. 4, 1944.

Canadian Patents

Dry Blended Fudge Mix Made to Contain 15 Percent Solidified Sirup Containing 65 Percent Maltose and Dextrose—Arthur P. Hellwig, Hartsdale, and Emil G. Fisher, New York, N. Y., to American Maize-Products Co. No. 417,343. Dec. 28,

Eggs Mechanically Cleaned While Moving Between Opposed Brushes Operating Reciprocally Through Horizontal Parallel Planes—Roy Stanley Davis, Otsego, Mich. No. 417,502. Jan. 4, 1944.

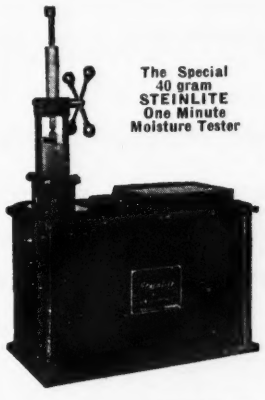
Milk or Cream Treated With Carbon Dioxide Prior to Churning, Gathering, Washing and Cooling Without Contact With Air or Light—James Senn, Berne, Switzerland. No. 417,521. Jan. 4, 1944.

Milk and Like Packaged in Containers Closed With Preformed Hood Caps Having Thermoplastic Adhesive to Secure Folds of Caps Around Container Neck—Carl W. Goodwin, North Plainfield, N. J., and Harold W. Martin, Malverne, N. Y., to American Seal-Kap Corp., Wilmington, Del. No. 417,525. Jan. 4, 1944.

Cheese Coated With Wax-like Composition Having Extended Plastic Range and Consisting of Amorphous Wax and Up to 30 Percent of Rubber Base Thermoplastic Condensation Product—James D. Ingle and Leon D. Mink, to Industrial Patents Corp., Chicago, Ill. No. 417,845. Jan. 18, 1944.

Cocoa Beans Heat-treated in Closed Container by Steam Under Pressure as Substitute for Usual Roasting—William J. Plews, to Quaker Oats Co., Chicago, Ill. No. 417,869. Jan. 18, 1944.

FOOD FIGHTS for freedom
THEY FIGHT TO PROTECT YOU
We, to protect their food — and yours.
JAMISON COLD STORAGE DOOR CO.
HAGERSTOWN, MD.
Branches in principal cities
JAMISON-
BUILT COLD STORAGE DOORS



BOOK YOUR STEINLITE ORDER NOW!

We can make IMMEDIATE SHIPMENT from stock now. But if you wish to wait, permit us to make shipment within 60-day period, just ahead of your busy season. No down payment required . . . 10 day FREE trial.

SAVE TIME . . . with a STEINLITE

In the process of dehydrating foods, moisture tests can now be made in one minute. No longer is it necessary to wait 20 or 30 minutes for the correct reading as with other moisture testers. The Steinlite eliminates all this time-consuming effort because it is FAST. Your time is valuable; Save it with a Steinlite.

The Steinlite is ACCURATE—checked against official government oven methods.

EASY TO USE—almost as easy as tuning a radio.

INEXPENSIVE TO OPERATE—consumes no more electricity than a 40-watt bulb.

PORTABLE (light weight), neat and compact.

"HEADQUARTERS" for all Grain and Seed Testing Equipment

SEEDBURO EQUIPMENT COMPANY

Formerly SEED TRADE REPORTING BUREAU FOUNDED 1912

634 BROOKS BUILDING CHICAGO 6, ILLINOIS

DID YOU KNOW?

NATIONAL

supplies large quantities of
ADHESIVES & STARCH PRODUCTS

for winding fiber Shell Containers

for packaging Small Arms Ammunition

for insulating Armored Tanks

for fabricating fiber Oil Filters & Motor Gaskets

for sizing duck Gun Covers

for making Rifle Envelopes

for binding sand Molds & Cores used in casting Gun Mounts, etc.

for assembling Fuses & Grenades

for laminating paper Bomb Rings

for sealing & labeling fiber Export Cases of Parts & Supplies

&

for many other ordnance applications . . . some of a secret nature . . . which contribute to the fire-power of our fighting forces.

Number 2 of a Series

THE U. S. ARMY

ORDNANCE DEPARTMENT

provides the FIREPOWER!

THE COURAGE and bravery of our ground and air forces would be costly and ineffective were it not for the weapons and mobility provided by Army Ordnance.

In no other war agency could a deadline failure in the production or shipment of needed guns, ammunition and automotive equipment mean so much to the safety of our boys on the battlefronts, and to the cause for which they are fighting.

National is proud of the high trust that is placed in its adhesives and starch products for such vital war applications as those shown at the left . . . and eager to give first call on its research, service and production facilities to the needs of our armed forces.

NATIONAL ADHESIVES

DIVISION OF
NATIONAL STARCH PRODUCTS INC.
270 MADISON AVENUE, NEW YORK 16, N. Y.

PLAINFIELD, N. J. • PHILADELPHIA, PA. • BOSTON, MASS. • CHICAGO, ILL. • INDIANAPOLIS, IND. • SAN FRANCISCO, CAL.

Controlled Air Protects Quality

(*Continued from page 72*)

deg. F. the moisture condensed out of the air will freeze, causing various operating difficulties. From a practical viewpoint, the lowest dewpoint to which air could be cooled by this system is 36 to 38 deg. F. Considering that most packaging rooms will be maintained at a dry-bulb temperature of 75 to 80 deg. F., it is apparent that the room relative humidity could not be maintained much below 25 percent. If the nature of the product were such that it was necessary to hold a lower humidity, the selection of an absorbent-type air conditioning system is clearly indicated. This latter type can easily produce dewpoint temperatures below 32 deg. F. and it is the obvious choice in the low dewpoint range.

However, the effective range of both basic systems overlap, and in such instances no "hard and fast" rules of selection can be set forth, the final choice being dependent on careful consideration of such variables as:

1. *Character of the "load."* Where the moisture load represents a very large portion of the total, the absorbent-type system might be favored, and vice versa.

2. *The relative costs of utility services.* The primary source of energy for the straight refrigeration system is electrical power, but where absorbent equipment is used, the main source of energy is gas or steam (for reactivation of the dehydrating medium).

3. *Considerations of space.* Generally, the refrigeration and reheat system is much more compact.

4. *The availability and temperature of cooling water.* It is possible to operate the refrigeration-plus-reheat system with practically no water by the use of evaporative condensers. This is not true of the alternative system.

5. *Comparative first costs.*

It should be noted that whereas the relative humidity to be maintained in the packaging room is dependent upon the regain characteristics of the products handled, the temperature to be maintained is determined by independent considerations. In cases where the temperature has little effect on the product, it will most often be set at a point consistent with employe comfort, which usually means a temperature of about 80 deg. F. On the other hand, temperature has a decided effect on some products, as in the case of bouillon cubes where, because of the fats in the product, compression of the powder is aided by low temperature and a definite upper limit is established.

When the nature of the product requires extremely low humidities, precautions should be observed in the construction of the packaging room that will prevent the inward seepage and leakage of moisture through walls and cracks, just as, in the case of cold storage rooms, insulation is used to prevent inward leakage of heat.

Whatever the conditions to be maintained, by whatever system is most suitable, modern air conditioning equipment can provide weather "made to order" for the food processor. This regulated weather will insure careful control of moisture content in the final product and uninterrupted production at maximum efficiency at all times—to say nothing of the incidental benefits of improved labor relations.

Dehydraters for Small-Scale Operations

(*Continued from page 75*)

containing a separate thermostatically-controlled heater, a propeller-type fan, and an automatically controlled exhaust system. Metal trucks suspended on a monorail are fitted with two sets of staggered guide rails to hold two sets of all-metal trays in slanting positions. Each truck is fitted with a solid back to close the openings left between cabinets and at the end, so that a different temperature and humidity can be maintained in each section. The four-blade propeller fans are installed on opposite ends of each cabinet in order to reverse the direction of the air in each section to insure uniform drying. With this arrangement great care must be used in the detailed design to prevent useless short-circuiting of the air between adjacent high-pressure and low-pressure regions. Secondary drying is carried out in a series of three counterflow tunnels built parallel to each other and in line with the through-circulation cabinets, and connected by means of the monorail. The practice is to maintain a high initial drying temperature in the first unit and slightly lower ones in the other sections, i.e., a range of 200 to 210 deg. F. down to 175 to 185 deg. F. Each section holds two trucks of trays, the single trucks being pushed in the first section at 15- to 20-minute intervals. As the trucks leave the last section, they are turned lengthwise on the monorail and conveyed into one of the thee finishing tunnels. Drying is completed in a series of equalizing bins.

Duplex Cabinet System

Another system recently developed for commercial installations employs a battery of four duplex cabinet dehydraters. These duplex units are placed side by side in line, each fitted with two sets of doors so that the trucks go in at the front and out at the back. Each duplex unit consists of two independently controlled air conditioning systems, one system to provide optimum primary conditions for dehydration, the other to provide optimum finishing conditions. These independent systems make it possible to maintain two efficient temperature ranges in the same unit without the use of partitions. The primary chamber is designed to give extremely rapid drying by the use of high temperature and air velocity during the period when the product is still wet. As drying progresses in this primary chamber, the initial high dehydration temperatures can be manually or automatically lowered. The secondary or finishing chamber is designed to remove the remaining moisture from the material at temperatures that will not cause scorching or other damage. The recommended operation procedure is to load two trucks with the prepared product and push them into the primary chamber of the first duplex unit, and this is repeated in the other three units. After two hours' dehydration in each unit at a temperature range beginning at 190 deg. F. and lowered to 160 deg. F., the two trucks are moved over into the finishing chamber and given an additional two hours' drying at a temperature range of 160 deg. F. down to 145 deg. F. Two newly filled trucks are put in their places in each of the primary chambers, and this same procedure is carried out continuously. At the end of the 4-hour drying period, the trucks are removed from the finishing chamber and the product dried to 7 percent or less moisture in an equalizing bin and then packaged.

The continuous production of dehydrated products from a battery of cabinet dryers, with or without auxiliary finishing tunnels, should be based on a regular scheduling of batches of the raw material from the preparation line, through the dehydrater, and into the final package. The whole process should be so arranged that the product flows smoothly from step to step without unnecessary delay at any point. The quality of the finished material will be lowered if the raw material is allowed to stand for any length of time during the preparation stages, and

YARWAY Spray Nozzles

for WASHING • RINSING • COOLING • HUMIDIFYING

INVOLUTE TYPE FOR CONE-SHAPED SPRAY

Get the most out of your Spraying Equipment without unnecessary power or liquid waste.

Use Yarway Nozzles. No internal vanes or other restrictions to clog or hinder flow. Two types—Yarway Involute type producing a fine cone-shaped spray with minimum energy loss, and Yarway Fan type producing a flat, fan-shaped spray with time-saving slicing action for cleaning.

Wide range of standard sizes and capacities. Cast or machined from solid bar stock.

Many thousands in use. Write for literature.

YARNALL-WARING CO., 127 Mermaid Ave.
Philadelphia 18, Pa.

FAN TYPE FOR FLAT SLICING SPRAY

gee, Jake

Go easy with the cleaner

CLEANING KNOW-HOW: "Rule o' thumb" measuring may turn out all right, and again it may not. It pays to be accurate in order to save materials as well as irreplaceable equipment.

Measure Metso Cleaners accurately. Many cleaning operations need but an ounce per gallon of water to remove grease and dirt efficiently. And this quantity also protects the sensitive surfaces such as tin and aluminum.

Metso direction circulars for various food industries will be useful to your inexperienced help. Free on request.

metso Cleaners

Sodium Metasilicate U. S. Pat. 1898707

PHILADELPHIA QUARTZ CO. • DEPT. D, 125 S. THIRD ST., PHILA. 6

scorching may occur if the material is not moved through the cabinet dryers at scheduled time intervals. All cabinets must be heated during the operation period and considerable heat losses will occur if the cabinets are not kept filled at all times.

Acknowledgment

The author wishes to acknowledge his indebtedness to H. H. Hammerstrom of the Laboratory of Fruit and Vegetable Chemistry for his assistance in designing the cabinets shown in Figs. 1, 2 and 3.

Industry Needs Accurate Test for Vitamin A

(*Continued from page 92*)

margarine should approximate (64/87) × 13,500 = 10,000 units per pound.

An intermediate example from the table would be oil No. 91 with an instrument potency of 185,000 units per gram and an average bio potency of 156,000 units per gram, but with concordant results by the bioassay laboratories reporting. When this oil is used at 50 percent excess on the basis of 156,000 units per gram, the instrument results on the finished margarine would approximate (185/156) × 13,500 = 16,000 units per pound, and both bio laboratories should pass the product safely at the usual 9,000 units per pound level.

Another intermediate example with a considerable difference in bioassay results would be oil No. 119, which has an instrument potency of 473,000 units per gram and bio results of 342,000 and 470,000 (average 406,000) units per gram. In this case, with 50 percent excess on the basis of 406,000 units per gram, the instrument results would approximate (473/406) × 13,500 = 15,700 units per pound on the finished margarine, whereas the two bioassay laboratories, assuming consistent results, should find about (470/406) × 13,500 = 15,600 and (342/406) × 13,500 = 11,400 units per pound.

Table III presents a collection of data on enriched margarines. This compares the potency of the finished margarine expected on the basis of determinations on the oil used. For the instrument method the actual potency was determined on the margarine oil before churning, calculated to the conventional basis of units per pound of finished margarine with 80 percent fat content.

The enrichment oils were subjected to multiple-level bioassays by laboratories A and B. On the basis of these, the enriched margarines would be ex-

pected to have the potencies indicated. The finished margarines were then submitted to Laboratory A for multiple-level bioassays and the log-dose interpolated results tabulated in the last column. All figures were rounded off to the nearest hundred units.

The variation in bioassay results in the last three columns again confirms the contention that a 50 percent excess is required, because biological test results on the margarines do not coincide with the results expected from the bioassays of the enriching oil used in individual cases. It is also interesting to note that the biological results on the finished margarines are both higher and lower than the results in the other columns. In a few words, the results are in accordance with the reproducibility of the bioassay technic.

References

1. *Journal of the American Pharmaceutical Association*, vol. 31, pages 124–6, 1942 (several authors).
2. Annual Review of Biochemistry, vol. 12, pages 353–361, 1943.

Also H. W. Vahlteich, *Food Industries*, vol. 13, page 39, June, 1941.

Protein Concentrate Obtained from Grass

(Continued from page 79)

line and more efficient methods of expressing the protein solution from the grass should increase the yield and more complete washing of the protein precipitate may alter its composition.

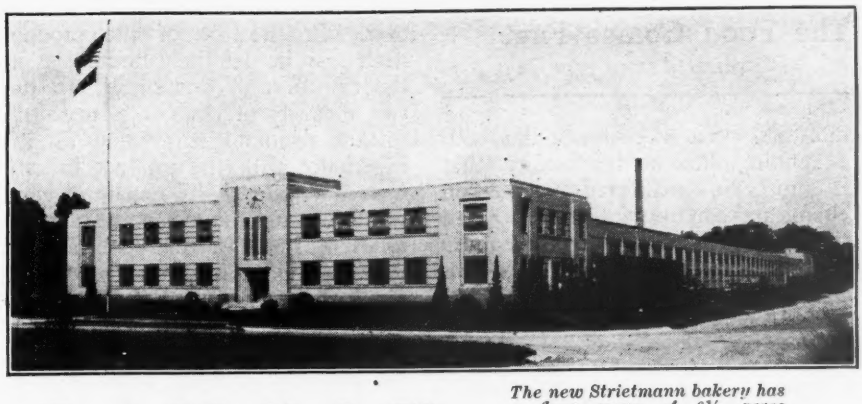
The feeding value of these products has not yet been determined.

References

1. Anonymous, *British Medical Journal*, No. 4235, 332–3, 1942.
2. Chibnall, "Protein Metabolism in the Plant," Yale University Press, 1939.
3. McLean and Imperial Chemical Industries, Ltd., British patent 513,896, Oct. 25, 1939.
4. McAnally, *The Biochemical Journal*, vol. 36, 392–9, 1942.
5. Pirie, *Chemistry & Industry*, 61, 45–8, 1942.
6. Slade, Birkinshaw and Imperial Chemical Industries, Ltd., British patent 511,525, Aug. 21, 1939.

Acknowledgments

In the article "New Methods Devised to Solve Glass-Pack Problems," by Frank Yourga, appearing in the February issue of Food Industries, page 94, space limitations caused the omission of the following acknowledgments: "Karl Ford, an authority on food processing, contributed greatly to the organization of the laboratory. Andrew G. Osborne, Aluminum Seal Co., made it possible to obtain the all-important processing retort discussed in the article."—The Editors.



The new Strietmann bakery has a floor space of 6½ acres

LAMSON Conveyors

helped this Ultra-Modern Bakery Achieve Greater Production . . . AT LOWER COST!

● Having outgrown several buildings in its long and progressive history, the Strietmann Biscuit Company of Cincinnati set out, before the war, to erect the most modern and efficient plant that could possibly be built. Lamson engineers cooperated from the time the first blueprints were being prepared.

● The result is a notably efficient production unit, with materials moving uninterruptedly from the receiving department, until they are delivered as finished products to the shipping platform. The flow of cartons is synchronized with the flow of goods, and both can be easily regulated. Provision has been made at every point for changes in size of cartons, and for shifting from dump-pack to hand-pack, as required.

● A detailed description of this superb plant appears in the "Lamson Conveyor" for December, 1943. If you would like a complimentary copy, please fill in and mail the coupon below.

Straight line production is accomplished by these main line conveyors

Large cartons are lifted from the basement to the main floor production line by the squeeze-belt booster

LAMSON Conveyors

LAMSON CORPORATION,
Syracuse 1, New York

Please send me a copy of the "Lamson Conveyor" describing the conveyor system in the Strietmann Biscuit plant.

Name .....

Company .....

Address .....

The Food Comes First

(Continued from page 74)

moisture vapor accession or loss with a definite differential humidity, that it must be unaffected by certain chemical conditions, and so on throughout the list. With the minimum specification determined, it is possible to turn intelligently to other factors which affect the ultimate choice.

Effect of Marketing Methods

The package specifications will also have to be examined from another standpoint—that of the suitability to withstand conditions in service. These depend on marketing methods and distribution, as well as on the foodstuff itself.

As nearly as possible, the temperatures and humidities which will be met by the packaging material in filling, storage and distribution should be determined. For instance, frozen storage, or refrigerated storage, may require a high wet strength in the package, even though the product itself is dry.

The question of how long the package must survive may be answered entirely on the basis of marketing methods, as in the well-known case of coffee packaged for very quick turnover. Or the life of the product itself may be definitely limited, as in the case of milk and bread. In the vast majority of cases it is necessary for the technologist to draw on his experience with the product to estimate how long it will remain in good condition, and the maximum time before it will be unsalable under average storage conditions. Sometimes, accelerated tests can be devised, and sometimes it is possible to find a fairly definite reaction which will indicate the progress of aging. But it is in the field of marketable life that the package designer, the technologist and the executive must collaborate.

Product Modification

There are a few further points which may be brought into a comprehensive packaging survey from the standpoint of the food technologist, when the survey indicates a need for package protection which will be more expensive than the product can afford, or when elaborate and inconvenient packaging seems otherwise required.

Minor additions to the formula can, in some cases, reduce the protection required, and hence the cost of packaging. A stabilizer, an antioxidant or a moistening agent may eliminate troublesome requirements. Use of a neutral substance as a carrier may prevent flavor loss. Mechanical separation of one part of the mixture may simplify the package. This is the case with dehydrated chicken-noodle soup, where the fat is placed in a gelatine capsule, while the seasonings and vegetable flakes may be in a small envelope within the simple carton required for the noodles.

Changes in the mechanical condition of the product have also been used, such as the compression of dehydrated foods.

Internal Reactions

Finally, a survey should help in recognizing the problems which can never be solved by packaging. An oxidation-reduction system such as that of ascorbic acid and certain pigments may exist within the product, so that the reaction will proceed, at a rate dependent on time and temperature, even in the absence of oxygen. Lipolysis, saponification, and other types of chemical combination or degredation may take place slowly between two or more constituents in some types of mixtures. Where such inner instability exists, there will be a noticeable lack of response to increased protection in test packages on aging, and possibly a marked effect of storage temperature, regardless of the type of packaging.

What About Lubrication For This VIKING PUMP?
Always keep the Grease Cups Filled With A GOOD GRADE Of Grease!
NUMBER SIX OF A SERIES

How To Get The Most Work Out Of Your VIKING PUMPS

It is absolutely essential that Viking Rotary Pumps be properly lubricated if you are to enjoy the benefit of rugged, dependable service that is built into each and every one of these units. Always use the best grade of grease obtainable for the service involved. Consult your oil company or supply house if in doubt. Or Viking experts here at the plant will be glad to submit definite recommendations if you will write and give us complete data. Remember, please, that grease is cheaper than repairs.

Get *extra* wear out of your Viking Pumps by giving them *extra* care. The Viking Service Manual tells you how. It's a handy, illustrated booklet giving you practical help in mounting, operating and maintaining Viking Pumps. Write for your copy today. It's FREE.

VIKING PUMPS — FIRST IN AMERICA

VIKING Pump COMPANY
CEDAR FALLS, IOWA

LECITHIN HEADQUARTERS of AMERICA

LECITHIN *for* **FOOD** AND **TECHNICAL PRODUCTS**

ROSS & ROWE, INC.
75 Varick St. New York 13, N. Y.
Wrigley Bldg. Chicago 11, Ill.
SOLE SELLING AGENTS FOR
AMERICAN LECITHIN CO.

FOOD TECHNOLOGY

NEW DISCOVERIES AND INVENTIONS

CEREAL PRODUCTS

Thiamine Control Test

SIMPLIFICATION and shortening of the process for determining thiamine has become essential since many flour mills are producing flour to meet a minimum thiamine specification. The present authors have developed a modification of the thiochrome test which will give duplicate results in about 50 minutes.

The sample is heated in a centrifuge tube at 70 deg. C. for 30 minutes with a 25 percent solution of potassium chloride in dilute acetic acid, then centrifuged at about 2,500 r.p.m. for 5 minutes. The supernatant solution is oxidized and the fluorescence determined on the isobutanol extract in the usual manner.

Corrections, according to a simple equation, must be applied in the case of unenriched flours, in order to bring the results into agreement with the regular thiochrome method. Results on enriched flours, and on the wheat grain, did not require any correction, the agreement with the standard method being within the experimental error. Bran and shorts give high figures, and wheat germ results are low. The discrepancy in the case of the germ is attributed to the presence of cocarboxylase. No explanation can be offered for the high results on shorts and bran.

Digest from "A Rapid Method for the Determination of Thiamine in Wheat and Flour," by A. Hoffer, A. W. Alcock and W. F. Geddes, *Cereal Chemistry*, vol. 20, 717–29, Nov., 1943.

Thermophile-free Starch

PATENT 2,108,862, covers a method which produces thick boiling starch by use of chlorine. A new patent covers changes in the process which produce a starch free of thermophilic bacteria but with a viscosity only slightly greater than that of the untreated starch. The product is excellent for use in thickening canned soups and other such products.

The starch is treated in a tower with 0.165 to 0.55 percent of chlorine (on the dry starch) for 50 to 180 minutes at 95 to 105 deg. F. Sodium hypochlorite may be used if the tower operation is not possible, but at such a low pH that it acts as free chlorine.

A disodium phosphate or other acceptable buffer must be incorporated in the starch, so that it will take up the acidic materials, mainly chlorofatty acids, which otherwise would produce thinning in the final product.

Digest of U. S. Patent 2,332,320, issued Oct. 19, 1943, to R. W. Kerr and assigned to Corn Products Refining Co., New York, N. Y.

BACTERIOLOGY

Increase in Cell Size

DOUBLING of the cell volume of *Torulopsis utilis* has been brought about by treatment with camphor. This increase in cell size has been found to be permanent, in that it persists even in cultures of the new strain which have not had contact with camphor for hundreds of generations.

Separation of yeast from the fermented wort had been difficult in the synthesis of protein by this organism, because of the variation in cell size of the yeast and particularly because of the prevalence of very small cells toward the end of the fermentation period.

Neither colchine nor α-naphthylamine, which were first investigated, produced changes in the cell size, but other bicyclic terpenes — borneol, bornyl acetate and camphene—have been found capable of producing changes in cell volume.

The protein and vitamin contents of the yeast produced by the new strain are very closely the same as those of the mother strain, and the yield of dry yeast per unit of carbohydrate fermented is the same.

Digest from "Preparation of a Giant Strain of *Torulopsis utilis*," by A. C. Thaysen and M. Morris, *Nature*, vol. 152, 526–28, Nov. 6, 1943.

Sublethal Preheat Assists Germination

POTENTIALLY dormant spores are of economic significance, since delayed germination and high resistance to heat are intimately associated phenomena.

Tests were made with several organisms, including *Bacillus megatherium, Bacillus subtilis, Bacillus cohaerens*, and the National Canners Association organisms No. 4149, and No. 9499.

When these mesophilic bacteria are heated at sublethal temperatures before incubation, there is a marked reduction in the number of spores which do not germinate. Best results were obtained by preheating at 85 deg. C. for 8 minutes. Lower temperatures, 65 and 75 deg., were less effective, while 95 deg. C. showed a direct lethal effect.

The effect of heat upon germination is materially influenced by the medium in which they are heated. Those tested included distilled water and evaporated milk. The energizing effect of the preheat is persistent, since there was little change in the number of spores not germinating when incubation, instead of following immediately on the heat treatment, was delayed by as much as 7 days.

Measured by the number of viable spores remaining, preheating at 85 deg. C. for 10 minutes, incubating for 3 hours at 37 deg. C. in glucose broth and again heating for 10 minutes at 85 deg. C. was more effective than incubating for 24 hours at 37 deg. C. (without preheating) and then heating for 10 minutes at 85 deg. C.

Digest from "The Accelerating Effect of Sublethal Heat on Spore Germination in Mesophilic Aerobic Bacteria," by F. R. Evans and H. R. Curran, *Journal of Bacteriology*, vol. 46, 513–23, December, 1943.

STABILIZERS

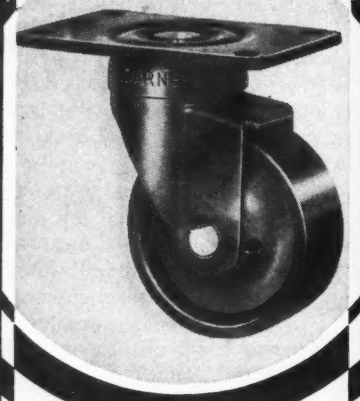
Emulsion Stability Tested Mechanically

BECAUSE of the increase in number and type of emulsifiers commercially available, it has become important to have a test which will give a fairly rapid quantitative measure of the stability of emulsions stabilized with different agents.

One such measure can be obtained from the resistance of the emulsion to breaking under mechanical stress, and centrifuging is here proposed as a means for obtaining a measurable destructive force. The work reported has been entirely on chemical emulsions such as those of cresol, aniline, toluol, kerosene; but it seems that the method would be applicable to food problems.

The authors point out that it is advisable always to determine the stability of an emulsion under the proposed conditions of use, in order to decide whether a more rapid method gives a valid measure.

Pre-tested for Performance



DARNELL CASTERS

• Save Money, Floors, Equipment and Time by using DARNELL Casters and Wheels . . . Always dependable, these low-cost floor protection products have been made to give you a long life of efficient, trouble-free service.

DARNELL CORP. LTD.,
LONG BEACH, CALIFORNIA,
60 WALKER ST., NEW YORK, N. Y.
36 N. CLINTON, CHICAGO, ILL.

Details of the centrifugal test and results of some tests are given in the article.

Refer to "Determining the Mechanical Stability of Emulsions," by R. C. Merrill, Jr., *Industrial and Engineering Chemistry, Analytical Edition*, vol. 15, 743–46, December 15, 1943.

DEHYDRATED FOODS

Egg Powder

ACCELERATED storage tests on spray-dried whole egg powder were made at 122 deg. F., since it was shown that changes at lower temperatures differed in extent and not in kind. Fluorescence and solubility tests were checked by palatability tests.

Removal of glucose by fermentation stabilized dried egg albumen, as shown by fluorescence, but did not prevent changes of fluorescence and solubility of dried yolk. There was some flavor change in the albumen due to fermentation, and the fermented yolk and whole egg powders had a disagreeable flavor, although little changed in odor.

Drastically reducing the moisture content of whole dried eggs had some beneficial effect on palatability, but at the end of 12 days at 122 deg. F. the eggs with less than 2 percent moisture showed considerable loss in palatability. Eggs with higher moisture content were considered inedible.

Reduction of moisture below 3 percent in the spray drier resulted in low solubility and high fluorescence. Low-moisture samples were obtained by further drying commercial dried eggs in desiccators under high vacuum and over phosphorous pentoxide.

Slight lowering of pH with 10 percent lactic acid prior to dehydration had a beneficial effect in whole egg powders with less than 1 percent moisture. A pH below 6.5 caused a marked and usually objectionable alteration in flavor and texture.

Digest from "A Study of Some Factors Affecting the Storage Changes in Spray-dried Egg Products," by G. F. Stewart, L. R. Best and B. Lowe, 1943 *Proceedings, Institute of Food Technologists*, 77–89.

Freezing and Drying

DEHYDRATION from the frozen state is covered by a recent patent. In this process the fruits or vegetables are quickly frozen, as with a cold inert gas, then dried in a tunnel with dry gas at a temperature sufficient to thaw the frozen material but low enough to prevent impairment of the color and flavor. Most of the drying takes place after thawing. The gas used may be nonoxidizing, with a high content of carbon dioxide.

In carrying out the process the prepared fruits or vegetables are placed on trays on trucks. A truck passes first into a freezing chamber, where the material to be dried is frozen in about 5 minutes. The loaded truck is then moved into the drying tunnel, through a gas-tight gate. Gas is circulated countercurrently, in a closed system provided with means for removing the moisture from the gas. For apricots, given as an example, the freezing is carried out at 15 to 20 deg. F., and drying at 33 to 45 deg. F. When carbon dioxide is maintained in the system the temperature may be increased to as much as 85 deg. F. without damage to the fruit.

It is claimed that the products resulting from such low temperature drying have good color and keeping qualities, and that they are in condition to rehydrate easily.

Digest from U. S. Patent 2,333,850, issued November 9, 1943, to Melville E. Dunkley, Vernalis, Calif.

CANNING

Oxygen Free Cans

ONE method of removing air from the headspace in canning noncarbonated juices, described in a patent granted recently, is to fill the headspace with an inert gas foam. This is done by passing the gas through minute orifices just beneath the surface of the liquid, immediately before the closing and sealing operation. The method is applicable to citrus juices, tomato juice and some other fruit and vegetable juices which have a surface tension such that the foam formed consists of very small bubbles.

Digest from U. S. Patent 2,333,898, issued Nov. 9, 1943, to A. E. Stevenson and J. M. Boyd, and assigned to Continental Can Co., New York, N. Y.

MISCELLANEOUS

Accelerated Aging

FRENCH investigators have found that artificial aging of wine can be rapidly induced by treatment with ultraviolet rays. A clear wine with a fine bouquet is produced.

Digest through *Technical Abstracts*, prepared by Research and Development Branch, Military Planning Division, Office of Quartermaster General, vol. 11, 865, November, 1943.

Preservative for Fish

REPORTS from Hungary indicate that preservation of fish during shipment is improved by use of "hyperol" as a bactericide.

Hyperol, or perhydrate, is a colorless and odorless combination of urea and hydrogen peroxide, containing 35 percent H_2O_2.

Digest through *Technical Abstracts*, prepared by Research and Development Branch, Military Planning Division, Office of the Quartermaster General, vol. 11, 861, November, 1943.

FOOD CHEMISTRY

Oxidative Reactions in Carbonated Beverages

In carbonated beverages the oxidation problem is confined to that amount of air trapped in the headspace of the container in filling. One method of preventing undesirable oxidation in such circumstances is to add a suitable oxygen acceptor, one somewhat more readily oxidized by molecular oxygen than the flavoring substances of the beverage and contributing no flavor to the product either in the reduced or the oxidized form.

A further requirement is that the acceptor in its oxidized form shall not be at such a potential as subsequently to oxidize the ingredients of the beverage.

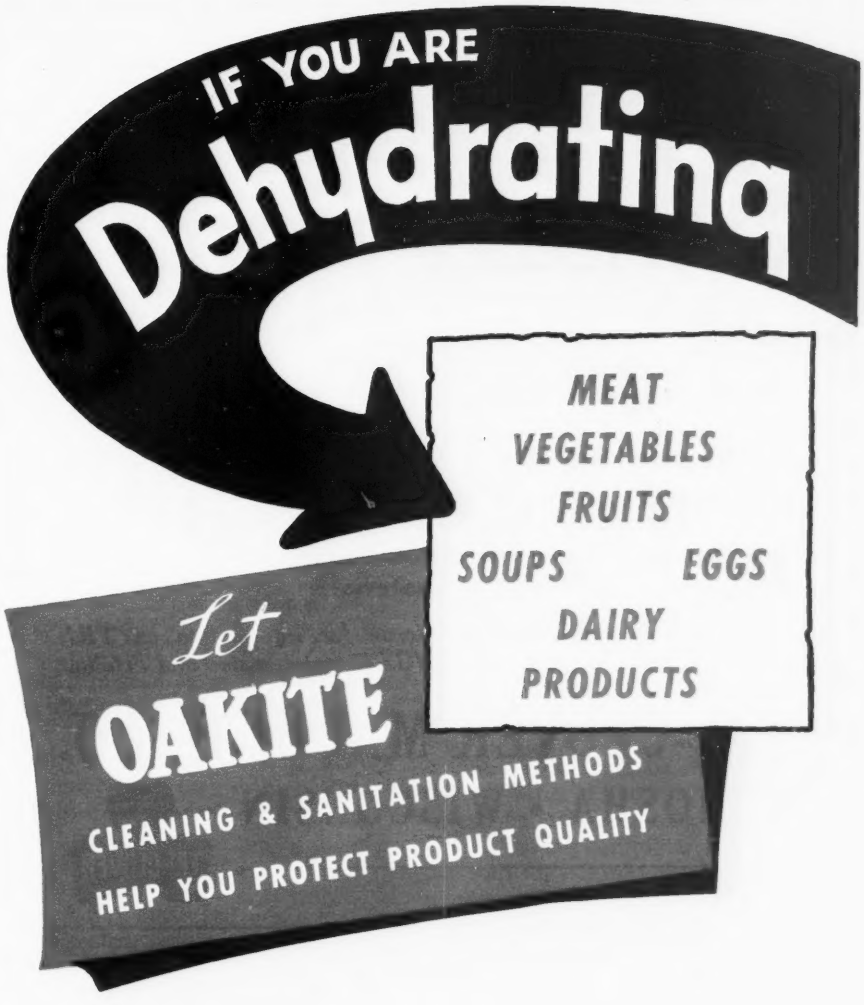
Of a group of substances having the endiol grouping COH = COH, which might serve as acceptors, only ascorbic acid, pyrogallol and dihydroxyacetone were readily oxidized at pH 7, and only ascorbic acid at pH 5.

A carbonated orange juice beverage was used for tests. There are two types of oxidation in such a solution. One results in loss of flavor and aroma, the other in the development of oily and bitter tastes, probably due to oxidation of terpenes. Ascorbic acid protected against both types.

In tests accelerated by exposure to strong sunlight, beverages to which essential oils had been added developed, after two weeks, a rather smooth, oily taste similar to mineral oil. Ascorbic acid protected the flavor and odor. Tests were made both by taste and odor, at room temperature. The odor test was found to be more sensitive.

Vitamin B_1 added as crystalline thiamine chloride accelerated the rate of flavor loss and caused development of a very characteristic and very bad musty and rubbery odor, which was always the same. This was not inhibited by vitamin C. The nature of the deteriorative change due to catalytic action of B_1 was not readily determinable. Respiration tests indicated that it could not be attributed to cocarboxylase, which is the active phosphorylated form of this vitamin.

Digest from "Control of Oxidative Flavors in Beverages," by C. A. Shillinglaw and M. Levine, *Food Research*, vol. 8, 453–63, November-December, 1943.



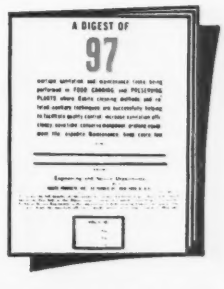
AMONG the many factors in the dehydration of foods that can affect their flavor and keeping-quality . . . is neglect to maintain necessary sanitation and cleanliness of processing and handling equipment.

Using incorrect methods or materials to remove various contaminating deposits from equipment usually results in trouble of some kind.

It is why we suggest . . . take advantage of long, practical Oakite experience, techniques and materials that today are helping other food plants successfully put daily clean-up work on a trouble-free, low-cost basis.

New, Data-Filled Digest FREE!

Here is a NEW, unusually informative, 24-page Oakite Digest that gives time-proved methods and formulae for handling 97 essential food plant sanitation and maintenance tasks. Send for your FREE copy of this helpful wartime guide TODAY!



OAKITE PRODUCTS, INC., 26G Thames St., NEW YORK 6, N. Y.

Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE MATERIALS...METHODS...SERVICE — Buy Bonds for Victory — CLEANING FOR EVERY CLEANING REQUIREMENT

DARNELL CASTERS

• Save Money, Floors, Equipment and Time by using DARNELL Casters and Wheels . . . Always dependable, these low-cost floor protection products have been made to give you a long life of efficient, trouble-free service.

DARNELL CORP. LTD.,
LONG BEACH, CALIFORNIA,
60 WALKER ST., NEW YORK, N. Y.
36 N. CLINTON, CHICAGO, ILL.

Details of the centrifugal test and results of some tests are given in the article.

Refer to "Determining the Mechanical Stability of Emulsions," by R. C. Merrill, Jr., *Industrial and Engineering Chemistry, Analytical Edition*, vol. 15, 743–46, December 15, 1943.

DEHYDRATED FOODS

Egg Powder

ACCELERATED storage tests on spray-dried whole egg powder were made at 122 deg. F., since it was shown that changes at lower temperatures differed in extent and not in kind. Fluorescence and solubility tests were checked by palatability tests.

Removal of glucose by fermentation stabilized dried egg albumen, as shown by fluorescence, but did not prevent changes of fluorescence and solubility of dried yolk. There was some flavor change in the albumen due to fermentation, and the fermented yolk and whole egg powders had a disagreeable flavor, although little changed in odor.

Drastically reducing the moisture content of whole dried eggs had some beneficial effect on palatability, but at the end of 12 days at 122 deg. F. the eggs with less than 2 percent moisture showed considerable loss in palatability. Eggs with higher moisture content were considered inedible.

Reduction of moisture below 3 percent in the spray drier resulted in low solubility and high fluorescence. Low-moisture samples were obtained by further drying commercial dried eggs in desiccators under high vacuum and over phosphorous pentoxide.

Slight lowering of pH with 10 percent lactic acid prior to dehydration had a beneficial effect in whole egg powders with less than 1 percent moisture. A pH below 6.5 caused a marked and usually objectionable alteration in flavor and texture.

Digest from "A Study of Some Factors Affecting the Storage Changes in Spray-dried Egg Products," by G. F. Stewart, L. R. Best and B. Lowe, 1943 *Proceedings, Institute of Food Technologists*, 77–89.

Freezing and Drying

DEHYDRATION from the frozen state is covered by a recent patent. In this process the fruits or vegetables are quickly frozen, as with a cold inert gas, then dried in a tunnel with dry gas at a temperature sufficient to thaw the frozen material but low enough to prevent impairment of the color and flavor. Most of the drying takes place after thawing. The gas used may be nonoxidizing, with a high content of carbon dioxide.

In carrying out the process the prepared fruits or vegetables are placed on trays on trucks. A truck passes first into a freezing chamber, where the material to be dried is frozen in about 5 minutes. The loaded truck is then moved into the drying tunnel, through a gas-tight gate. Gas is circulated countercurrently, in a closed system provided with means for removing the moisture from the gas. For apricots, given as an example, the freezing is carried out at 15 to 20 deg. F., and drying at 33 to 45 deg. F. When carbon dioxide is maintained in the system the temperature may be increased to as much as 85 deg. F. without damage to the fruit.

It is claimed that the products resulting from such low temperature drying have good color and keeping qualities, and that they are in condition to rehydrate easily.

Digest from U. S. Patent 2,333,850, issued November 9, 1943, to Melville E. Dunkley, Vernalis, Calif.

CANNING

Oxygen Free Cans

ONE method of removing air from the headspace in canning noncarbonated juices, described in a patent granted recently, is to fill the headspace with an inert gas foam. This is done by passing the gas through minute orifices just beneath the surface of the liquid, immediately before the closing and sealing operation. The method is applicable to citrus juices, tomato juice and some other fruit and vegetable juices which have a surface tension such that the foam formed consists of very small bubbles.

Digest from U. S. Patent 2,333,898, issued Nov. 9, 1943, to A. E. Stevenson and J. M. Boyd, and assigned to Continental Can Co., New York, N. Y.

MISCELLANEOUS

Accelerated Aging

FRENCH investigators have found that artificial aging of wine can be rapidly induced by treatment with ultraviolet rays. A clear wine with a fine bouquet is produced.

Digest through *Technical Abstracts*, prepared by Research and Development Branch, Military, Planning Division, Office of Quartermaster General, vol. 11, 865, November, 1943.

Preservative for Fish

REPORTS from Hungary indicate that preservation of fish during shipment is improved by use of "hyperol" as a bactericide.

Hyperol, or perhydrate, is a colorless and odorless combination of urea and hydrogen peroxide, containing 35 percent H_2O_2.

Digest through *Technical Abstracts*, prepared by Research and Development Branch, Military Planning Division, Office of the Quartermaster General, vol. 11, 861, November, 1943.

FOOD CHEMISTRY

Oxidative Reactions in Carbonated Beverages

In carbonated beverages the oxidation problem is confined to that amount of air trapped in the headspace of the container in filling. One method of preventing undesirable oxidation in such circumstances is to add a suitable oxygen acceptor, one somewhat more readily oxidized by molecular oxygen than the flavoring substances of the beverage and contributing no flavor to the product either in the reduced or the oxidized form.

A further requirement is that the acceptor in its oxidized form shall not be at such a potential as subsequently to oxidize the ingredients of the beverage.

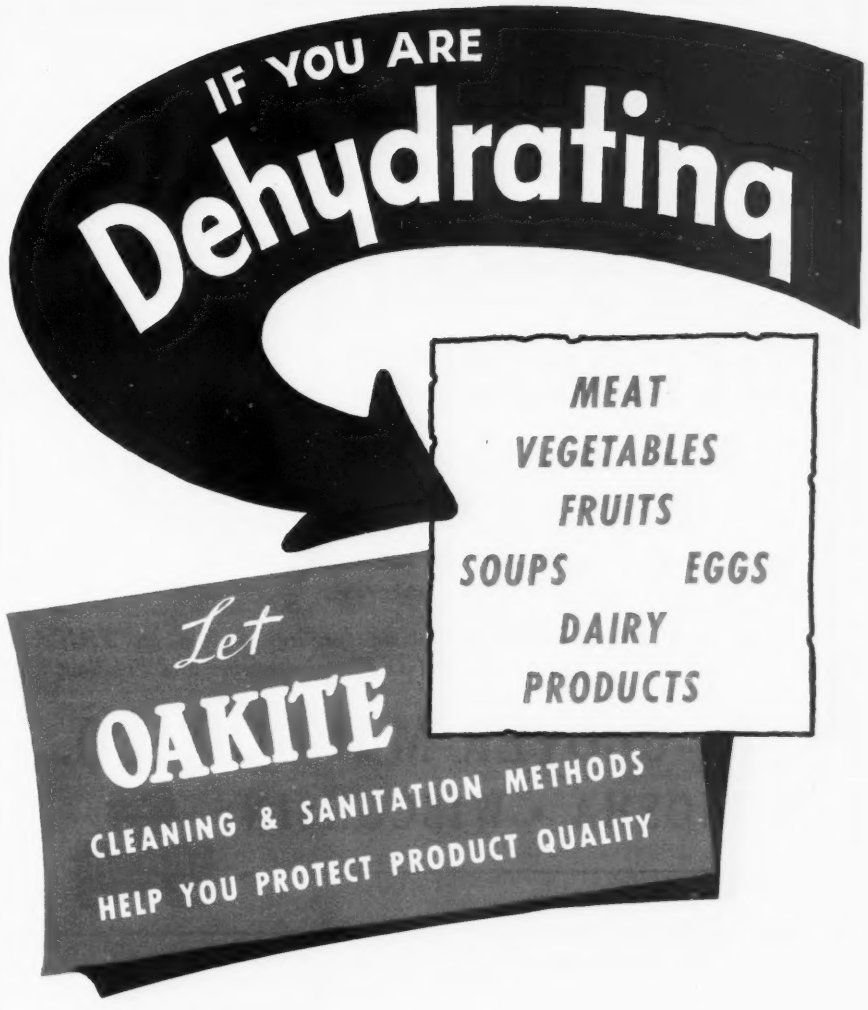
Of a group of substances having the endiol grouping COH = COH, which might serve as acceptors, only ascorbic acid, pyrogallol and dihydroxyacetone were readily oxidized at pH 7, and only ascorbic acid at pH 5.

A carbonated orange juice beverage was used for tests. There are two types of oxidation in such a solution. One results in loss of flavor and aroma, the other in the development of oily and bitter tastes, probably due to oxidation of terpenes. Ascorbic acid protected against both types.

In tests accelerated by exposure to strong sunlight, beverages to which essential oils had been added developed, after two weeks, a rather smooth, oily taste similar to mineral oil. Ascorbic acid protected the flavor and odor. Tests were made both by taste and odor, at room temperature. The odor test was found to be more sensitive.

Vitamin B_1 added as crystalline thiamine chloride accelerated the rate of flavor loss and caused development of a very characteristic and very bad musty and rubbery odor, which was always the same. This was not inhibited by vitamin C. The nature of the deteriorative change due to catalytic action of B_1 was not readily determinable. Respiration tests indicated that it could not be attributed to cocarboxylase, which is the active phosphorylated form of this vitamin.

Digest from "Control of Oxidative Flavors in Beverages," by C. A. Shillinglaw and M. Levine, *Food Research*, vol. 8, 453–63, November-December, 1943.



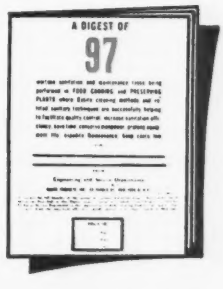
AMONG the many factors in the dehydration of foods that can affect their flavor and keeping-quality . . . is neglect to maintain necessary sanitation and cleanliness of processing and handling equipment.

Using incorrect methods or materials to remove various contaminating deposits from equipment usually results in trouble of some kind.

It is why we suggest . . . take advantage of long, practical Oakite experience, techniques and materials that today are helping other food plants successfully put daily clean-up work on a trouble-free, low-cost basis.

New, Data-Filled Digest FREE!

Here is a NEW, unusually informative, 24-page Oakite Digest that gives time-proved methods and formulae for handling 97 essential food plant sanitation and maintenance tasks. Send for your FREE copy of this helpful wartime guide TODAY!



OAKITE PRODUCTS, INC., 26G Thames St., NEW YORK 6, N. Y.

Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE MATERIALS . . . METHODS . . . SERVICE — Buy Bonds for Victory — CLEANING FOR EVERY CLEANING REQUIREMENT

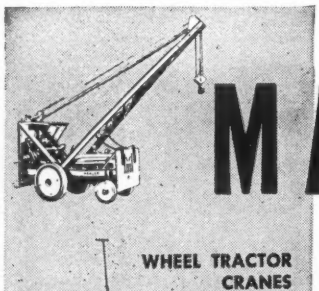
If you need sanitary fittings or pumps . . .

We can still offer you the most complete line in the industry—provided, of course, you are permitted to buy equipment of this type. This does not in any way interfere with the all-out effort we are making in the production of war material.

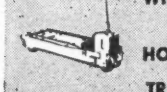
Check your requirements and write for information on TRI-CLOVER PUMPS and FITTINGS in stainless steel and Trialloy.

TRI-CLOVER MACHINE CO.
KENOSHA • WISCONSIN

Try TRI-CLOVER



MATERIALS HANDLING & PROCESSING EQUIPMENT



WHEEL TRACTOR CRANES
HOISTING UNITS
TRAILER TRUCKS

LIFT TRUCKS
CONVEYORS
CARTS & TOOL WAGONS
ELEVATORS

GYRO SIFTERS

CRUSHERS
CUTTERS
MILLS & MIXERS

PULVERIZERS
GRINDERS
COMPLETE INSTALLATIONS

The handling equipment construction "know-how" of the Mercer Engineering Works, Inc., Clifton, N. J. . . . The more than 40 years processing equipment experience of Robinson Mfg. Co., Muncy, Pa. . . . All are embodied in and represented by

MERCER-ROBINSON COMPANY, INC.
INQUIRIES INVITED
30 CHURCH ST., NEW YORK 7, N. Y.

Questions and Answers

Refining of Corn Oil

We have recently been told by a reader that the process of corn oil refining outlined in this department in July, 1943, does not represent the latest practice in the industry in some respects, although the information given was the best obtainable at that time.

1. Soda is not used to neutralize the free fatty acids, because traces of soda soap increase the rate of rancidity development. Corn oil must be refined to not more than 0.10 percent of free fatty acid to obtain maximum stability against rancidity. The 0.10 percent is a critical point and indicates that substantially all of the soda soap must be removed.

2. Substantially all the free fatty acids with a boiling point less than that of stearic, including oleic, can be removed by distillation under 10-mm. vacuum and 392 deg. F. This high-vacuum treatment removes the more volatile fatty acids that tend to impart off flavors and odors.

3. Fuller's earth specifications must be watched very closely, as this oil can be spoiled easily in filtration if the Fuller's earth contains a trace of iron.

Egg Albumin Substitute

New York—A number of our customers in both the confectionery and bakery fields have made inquiry of us with respect to the possibility of obtaining a substitute for powdered egg albumin. These inquiries resulted from certain unsuccessful efforts we made some time ago to produce such an item. Do you know of any such product?

We do not know of a successful egg albumin substitute. One soya protein product which showed some promise has been found to owe its whipping properties to an impurity, and there is some doubt about its suitability for this purpose. Edible gelatine is the only other material which has come to our attention as a suggested substitute for egg albumin.

With the present supplies of eggs as plentiful as they are, and with the demand by the government for dried eggs decreasing, there may be little need for egg albumin substitutes. Why not check with those concerns which were producing egg albumin for the bakery trade before there was such a demand for powdered whole eggs, to see if there is not a prospect that supplies will become available soon?

FORMULAS FOR FOODS

FORMULA NO. 453

Soy-Ginger Bread

Whole eggs	1 lb. 4 oz.
Enzyme-converted corn sirup	4 lb.
High-fat soya flour	4 lb.
Salt	3 oz.
Soda	8 oz.
Cinnamon	2½ oz.
Ginger	1⅛ oz.
Cloves	1⅛ oz.
Hydrogenated shortening	2 lb. 4. oz.
High-grade molasses	13 lb. 8 oz.
Water	12 lb.
Cake flour	10 lb.
Baking powder	4 oz.

Directions

Weigh the eggs, corn sirup and 3 lb. of water into the mixing bowl. Blend the dry ingredients except flour and baking powder by sifting, then add these and the shortening to the egg mixture. Blend and cream until light. Add the balance of the water alternately with the flour and baking powder, beginning and ending with the water. Mix smooth after each addition.

May be made up into layers, loaves or rings. Bake at 325 to 340 deg. F. until just barely done. Do not overbake. Loaf and ring pans should be lined with paper, layers greased and papered on the bottom. Cool in pans, but turn out before entirely cold.

Spices and molasses may be varied to suit the flavor desired. The amount of water required varies somewhat with the flour. The batter should be quite soft.

Formula from A. E. Staley Mfg. Co.

FORMULA NO. 454

Mello Base Cakes

Sugar	35 lb.
Shortening	22 lb. 8 oz.
Salt	1 lb. 4 oz.
Milk solids	2 lb.
Flavoring	as desired
Standardized invert sugar	15 lb.
Water	18 lb.
Ammonia	3 oz.
Soda	6 oz.
Cream of tartar	5 oz.
Flour	100 lb.

Directions

Cream together the sugar, shortening, salt, dry milk and flavoring. Meanwhile dissolve the invert sugar in part of the water, about 10 lb., and the ammonia in the remainder of the water. Separately blend the soda and cream of tartar with the flour. Add the invert sugar and ammonia solutions to the creamed mixture, along with the blended flour. Mix until the dough is smooth.

These low cost cookies are suitable to be made on a sheeter for topping with marshmallow. (See Formula No. 455).

Formula from The Nulomoline Co.

FORMULA NO. 455

Marshmallow Topping

Gelatine*	10 oz.
Water, cold	2 lb.
Flavor and color	as desired
Sirup, formula below	31 lb.

* Increase to 11 oz. in summer.

Directions

Soak the gelatine in the cold water, then heat until fluid but not over 140 deg. F. Add the fluid gelatine to the special sirup and beat to marshmallow consistency. Just before the beating is finished, incorporate the flavoring and color.

Sirup

The sirup must be varied to take care of summer and winter conditions, so two types of formula are given here:

	Summer	Winter
Water	36 lb.	33 lb.
Granulated sugar	90 lb.	63 lb.
Standardized invert sugar	90 lb.	120 lb.
Corn sirup	60 lb.	60 lb.

Dissolve the sugar in the water by heating. Simply using hot water will be sufficient for the winter formula, but the increased sugar in the summer formula will require heating to 150 deg. F. Add the invert sugar and corn sirup to the warm dissolved sugar. Stir until thoroughly mixed. This sirup may be made in any quantity desired and used as needed.

Formula from The Nulomoline Co.

FORMULA NO. 456

Mixed Meat Loaf

Cured meat*	100 lb.
Soya flour	7½ lb.
Corn flour	7½ lb.

* Beef, veal or mixed meats, not more than 20 percent fat.

Directions

Meat loaf should contain not more than 20 percent fat nor less than 80 percent meat. Be sure that all meats are cured.

Chop the meat more than half down with ice, then add the soya and corn flours. Finish chopping to a smooth stiff dough. During chopping add the seasoning mixture, using the following for each 100 lb. of the chopped meat mixture:

Ground celery seed	1½ oz.
Nutmeg	3 oz.
Ginger	1½ oz.
Coriander	2 oz.
White pepper	7 oz.
Sugar	12 oz.
Chopped onions	3 lb.

Raw hog livers may also be added during chopping, using 5 lb. to the amount given here. It is not necessary to cure the hog livers. They will improve the flavor, make a much brighter loaf when baked, and the loaves will brown better.

When the loaves are placed in the bake oven they should not be colder than 65 deg. F. at the centers.

The oven should be started at 175 deg. F. After 1½ hours the temperature should be raised gradually to 200 deg. F. and baking continued at that temperature for 45 minutes longer. The temperature at the center of the loaves should then be tested, using a dairy type thermometer. If they show 150 deg. F. in the centers they are done. If a deep brown color is desired, however, the oven temperature may be raised to about 300 deg. F. for 15 minutes.

Loaves must not be removed from the oven until it is certain that the temperature is 150 to 155 deg. F. in the centers. This will prevent molding, souring and discoloration, which may occur if the loaves are not thoroughly baked through to the center.

Formula from Stein, Hall Mfg. Co.

FORMULA NO. 457

Prepared Lemon Beverage

Sugar	64 lb.
Salt	2 oz.
Powdered lemon juice	2 lb. 8 oz.
Citric acid	1 lb. 8 oz.
California lemon oil	2 oz.
Lemon coloring	as desired

Directions

Place 48 lb. of sugar, the salt, powdered lemon juice and citric acid (or substitute) in a mixing bowl and blend thoroughly. Blend the lemon oil and coloring with 16 lb. of sugar and add this to the first mixture. Additional sugar may be used if desired. Put the entire mixture through a fine sieve.

To serve, make up in the proportion of 1 lb. of mixture to 1 gal. or more of water.

Formula from Parker-Broeg.

O & S *Powermaster* STEAM GENERATORS

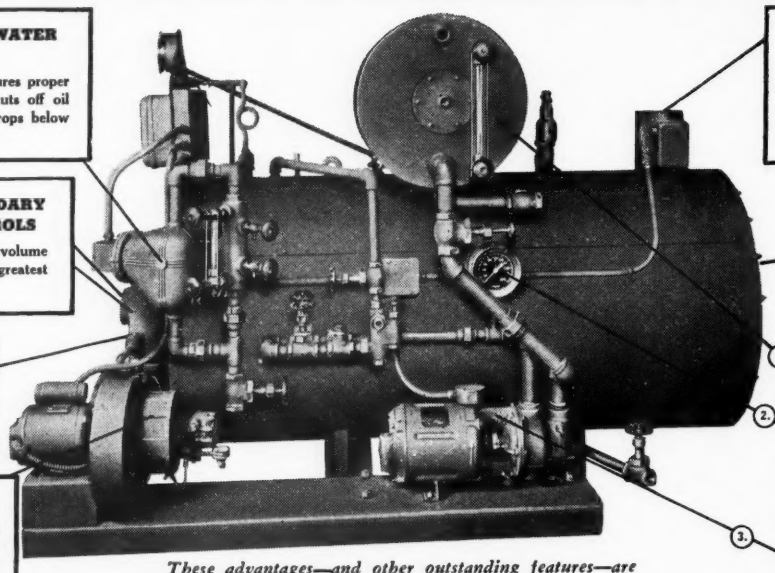
built to insure highest efficiency, safety, longer life!

AUTOMATIC LOW-WATER CUT-OFF
serves a dual purpose—assures proper water level in boiler and cuts off oil supply when water level drops below normal operating height.

PRIMARY AND SECONDARY AIR MIXTURE CONTROLS
which offer—with special air volume control — triple control for greatest efficiency.

SPECIAL OIL BURNER
designed for highest efficiency with this new unit.

AIR VOLUME CONTROL
which offers—with primary and secondary air mixture controls —triple control for greatest efficiency.



NO STACK NECESSARY
because boiler's complete combustion requires only small outlet to take away any flue gas.

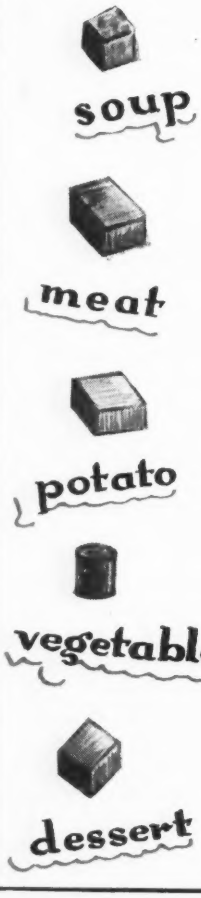
REMOVABLE BACK PLATE
permits easy access to washout plugs and tubes.

CONDENSATE RETURN SYSTEM
built-in to provide exceptional compactness and easy installation.

1. Make-Up Tank
2. Feed Water Gauge
3. Pump and Motor

These advantages—and other outstanding features—are more completely outlined in Powermaster Bulletin No. 1213. Write for your copy—to ORR & SEMBOWER, INC., 932 MORGANTOWN RD., READING, PA.

ORR & SEMBOWER INC. READING • PENNSYLVANIA — O&S — *Builders of Better Boilers Since 1885*



DEHYDRATION IS HERE

A complete dinner, dehydrated, gives you an idea of the many different foods that are dehydrated and shipped for military, Lend-Lease and civilian needs.

Dehydration takes moisture and bulkiness out of foodstuffs (nutrition is sealed in), promotes speed and economy in shipping, for in dehydrated foods less weight and less bulk means more food . . . taking up less space . . . ultimately feeding more people.

The packaging of these foods is a particularly important problem. Allied's bag-packages meet the requirements of this new market. This should open new lanes of business for your men and prove a fertile territory to cover.

• We are making every effort to fill all orders from our regular customers in addition to meeting the requirements of the war. Your cooperation is appreciated.

ALLIED
PAPER BAG CORPORATION
BAYARD & CARROLL STREETS
BALTIMORE-30, MARYLAND